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(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to April 14th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 139 Signal Service stations and 14 Canadian stations, as telegraphed to this office; 140 monthly journals and 158 monthly means from the former, and 12 monthly means from the latter; reports from 27 Sunset stations, 234 monthly registers from Voluntary Observers; 46 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Barometric Pressure.—The pressure for the month is remarkable for its equitable distribution from the Mississippi valley eastward to the Atlantic Ocean. As compared with the March averages of the preceding eight years the distribution is decidedly abnormal. From the Missouri valley eastward to the Atlantic an excess of pressure prevailed, averaging 0.05 above the normal and reaching 0.08 above over Lake Ontario. There was a slight deficiency in the pressure of the South Atlantic and Eastern Gulf States. An excess of 0.03 above prevailed at San Diego and San Francisco and of 0.06 above at Portland, Or. The mean at Virginia City was 0.03 below.

Local Barometric Ranges.—The barometric ranges in the Atlantic States regularly increased to the northward, from 0.34 at Key West to 1.09 at Norfolk, 1.18 at New York city and 1.48 at Thatcher's Island, with an extreme range of 1.57 at Burlington, Vt. The range on Mt. Washington, however, was but 0.96, being 0.50 below the average of the surrounding New England stations. A similar increase northward occurs from an average of 0.55 along the Gulf coast to an average of 1.30 in the Ohio valley and Missouri. Unusual ranges occurred in the Lake region and Upper Mississippi valley. The average range for the Lower Lake region is 1.40, the Upper Lake region 1.50 and the Upper Mississippi valley 1.60. Extreme ranges of 1.70 occurred at Milwaukee, Dubuque and La Crosse, of 1.73 at Madison, Wis. and 1.84 at Fort Buford. On the Pacific coast the range regularly increased to the northward from 0.44 at Los Angeles to 1.28 at Olympia and 1.39 at Umatilla. The pressure over the Plateaux and Rocky Mountain districts ranged from 0.45 in the southern part to 0.92 in the northern.

Areas of High Pressure.—During the month twelve areas of high pressure have appeared within the limits of the Signal Service maps. The most notable area is No. II, which remained stationary and without decided change of pressure in the North Pacific coast region from the 5th to the 15th.

No. I.—This area, central in the Ohio valley the morning of the 1st, moved slowly eastward and was central during the 2nd on the Middle Atlantic coast, and by the morning of the 3rd had withdrawn eastward over the Atlantic ocean. The highest pressure during its passage was reported from Cape Henry at midnight, the barometer being 0.48 above the normal. Cautionary Signals were displayed on the morning of the 2nd at Ft. Macon, Cape Lookout and Cape Hatteras. These signals were justified but remained displayed until the morning of the 4th in connection with low area No. I.

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No. II.—This area appeared on the Pacific coast during the 5th, the p. m. barometer at Red Bluff being 0.25 above the normal. During the 6th it moved slightly northward to the North Pacific coast region, where it remained until the afternoon of the 15th, the highest pressure being regularly reported at Olympia, rising at that station from 0.40 above the normal during the 6th to 0.67 above on the 8th, and 0.66 on the 12th. This area gradually dissipated in advance of low area No. XI. During the increase of pressure from the 6th to the 8th, rain fell in the North Pacific coast region. During the 8th while this pressure was increasing in Washington Territory the barometer fell sharply in the southern half of the Pacific coast region in connection with low area No. VII, which, moving southwestward from Wyoming, was central at midnight in southern California. Exceedingly high winds were reported in northern and central California, and maximum velocities of N. 44 miles at San Francisco and N. 36 miles at Sacramento were reported. In San Francisco Bay two schooners and one barge were sunk and eight other vessels more or less damaged. At Willows, Cal., a terrific gale prevailed during the forenoon, moving a church from its foundations and seriously damaging it. At Colusa several buildings were blown down and others seriously damaged; at Maxwell a warehouse was blown down; in Napa valley many buildings were blown down and large trees uprooted; at Dayton a barn blown down; at Livermore considerable damage was done; at San Leandro and in El Dorado county many trees were blown down. The minimum temperatures for the Pacific coast generally occurred during the continuance of this area.

No. III.—This area appeared on the afternoon of the 5th in the Missouri valley. It moved northeastward through the Ohio valley to New England and Nova Scotia, thence withdrawing northeastward over the Atlantic ocean by midnight of the 7th. The maximum pressure was reported from Halifax on the 7th, the barometer being 0.47 above the normal. In connection with this area Cautionary Signals were displayed on the morning of the 6th at Grand Haven, Milwaukee and Ludington, and were lowered on the 7th, having been justified; maximum velocity 26 miles NW. at Milwaukee. At midnight of the 6th Cautionary Signals were displayed on the Atlantic coast from Sandy Hook southward to Ft. Macon, which remaining displayed during the passage of low area No. IV are treated of in connection therewith.

No. IV.—This area appeared in the Northwest at midnight of the 6th; its pressure increased until the morning of the 7th, Fort Garry barometer 30.81 or 0.64 above the normal. On the morning of the 7th the Cautionary Signal at Indianola was changed to Cautionary Off-shore and in the afternoon a similar signal was ordered at Galveston. These signals were lowered during the afternoon of the 8th, having been justified by wind velocities of N. 28 and N. 36 miles. Moving eastward, on the morning of the 8th it was central in the province of Quebec—Rockliffe barometer 0.62 above the normal—and during the 9th it gradually withdrew eastward over the Atlantic ocean. The passage of this area was marked by the minimum temperatures for the month at most stations in the Lower Lake region, New England and New York, the lowest readings being 1° below zero at Burlington on the 8th and Eastport on the 9th. In connection with this area signals displayed for advancing low area No. III were changed at midnight of the 7th on the New Jersey coast from Cautionary to Off-shore, and were fully justified by velocities ranging from 26 to 36 miles from the North and Northwest. Cautionary Off-shore Signals were ordered the morning of the 8th at Boston and Portland, and the Cautionary Signals at Newport and Wood's Holl were changed to Cautionary Off-shore. These signals were lowered that evening, justified by wind velocities of NW. 36 at Thatcher's Island and NW. 28 at Boston.

No. V.—This pressure appeared in the Northwest the morning of the 9th, Fort Garry barometer 0.41 above the normal. Moving eastward through Canada it reached New Brunswick by midnight of the 11th, Chatham barometer 0.52 above the normal. During its passage, minimum temperatures for the month occurred at scattering stations in the Upper Lake region, the lowest readings reported being 6° below zero at Marquette and 8° below zero at Alpena on the 10th. Off-shore Signals were displayed at Sandy Hook at noon, from New London northward along the coast to Thatcher's Island in the afternoon, and at Eastport at midnight of the 10th. The signal at Eastport was lowered during the afternoon of the 11th, and at other stations changed during that day to Cautionary in connection with advancing low area No. VIII. The signals at New England stations were justified by velocities ranging from N. 26 at Eastport to W. 35 at Wood's Holl.

No. VI.—This area appeared in the Northwest on the 11th, and at midnight the pressure at Fort Garry was 30.91 or 0.80 above the normal and the temperature 18° below zero. Moving eastward at midnight of the 12th, the highest pressure was at Rockliffe, 30.68, or 0.74 above the normal. During the 13th the pressure withdrew eastward over the Bay of St. Lawrence. In connection with advancing low area No. VII Cautionary Signals were displayed during the 12th from Norfolk along the coast northward to Thatcher's Island, and were lowered on the morning of the 14th, having been generally justified by velocities ranging from 26 NE. at New York to 44 NE. at Delaware Breakwater, along the New Jersey coast, and N. 34 at Thatcher's Island.

No. VII.—This area appears to have been a part of the last area. On the 13th, moving southward from Manitoba, the highest pressure at midnight was central in the Missouri valley—Omaha barometer 0.45 above the normal. The area extending from the Lower Missouri valley southward to Texas remained substantially unchanged until the 17th, when, moving eastward, the highest pressure in the afternoon was at Cincinnati, the barometer being 0.33 above the normal. It withdrew slowly eastward from the New England coast over the Atlantic ocean during the 18th. During the passage of this area minimum temperatures of the

month occurred as follows: in the Upper Mississippi and Lower Missouri valleys on the 14th, (lowest reading 7° below zero at St. Paul and Omaha;) in Tennessee and part of the Ohio valley, the 16th and 17th, (lowest reading at Indianapolis, 21°;) in the Western Gulf States from the 14th to the 17th, (lowest reading 23° at Corsicana on the 14th.) At midnight on the 13th, the wind continuing brisk at Indianola, Off-shore Signals, which had been lowered that morning, were again displayed at Galveston, Indianola and Port Eads, and were continued to midnight of the 14th, when they were lowered, having been justified by velocities of 43 miles N. at Indianola, 31 miles at Galveston, and —— at Port Eads. On the afternoon of the 16th Cautionary Signals displayed in advance of low area No. X were changed on the New Jersey coast to Cautionary Off-shore Signals, and the Cautionary Signals from Cape Lookout to Cape Henry were continued. Cautionary Signals were displayed at Smithville and Wilmington on the morning of the 17th. The New Jersey coast signals were lowered the afternoon of the 17th, fully justified by velocities ranging from 25 NW. at Barnegat to 42 NW. at Cape May. Those on the North Carolina coast were lowered at midnight of the 17th, fully justified by velocities ranging from 32 NE. at Fort Macon to 48 NE. at Kittyhawk.

No. VIII.—This area appeared on the North Pacific coast during the 18th, the pressure at Olympia, from the 19th to midnight of the 21st, ranged from 0.48 to 0.59 above the normal. The area gradually dissipated during the 22nd. While the pressure was increasing during the 18th and 19th occasional light rain fell in Oregon; otherwise clear weather generally prevailed on the Pacific coast.

No. IX.—This area followed low area No. XI, central in the Northwest at midnight of the 19th, moved slowly southward to Texas, where it dissipated on the 22nd. The highest pressure occurred at Dodge City on the afternoon of the 20th, 0.35 above the normal. Cautionary Signals were displayed at New Orleans and Port Eads at midnight of the 21st, and were lowered at midnight of the 22nd. Reports, as yet received, do not show that they were justified. From the 20th to the 22nd easterly winds with maximum velocities, ranging from 27 to 38 miles, were reported from the Texas coast.

No. X.—The pressure in the Northwest rose very rapidly on the 23rd in rear of low area No. XIV. At the afternoon report the pressure at Breckenridge was 0.40 above the normal. Moving eastward with increasing pressure on the morning of the 24th it was central in the Upper Lake region, Marquette barometer 0.63 above the normal. Moving slowly eastward, it passed off the Middle Atlantic coast during the 25th. During its passage the minimum temperatures of the month occurred in the Middle Atlantic States, the southern half of New England and in Ohio. During the 23rd the Cautionary Signals ordered for low area No. XIV were changed to Off-shore from Norfolk northward to Portland, and on the following morning at Eastport. These signals were lowered during the 24th having been fully justified by velocities ranging from 30 NW. at Portland to 54 NW. at Wood's Holl on the New England coast, and from 36 NW. at New York to 56 NW. at Sandy Hook and Cape Henry and 44 N. at Kittyhawk along the Middle Atlantic coast.

No. XI.—This area appeared in the Northwest on the 28th and moving eastward continued on the Upper Lake region during the 29th and 30th. During the 31st it gradually disappeared. The highest pressure was reported from Marquette the morning of the 30th—0.42 above the normal. During the 29th occasional high winds were reported from Lakes Erie and Huron. No signals were displayed during the passage of this area.

No. XII.—During the 29th and 30th the pressure rose considerably above the normal on the Central Pacific coast, but fell below the normal on the 31st. The highest pressure reported was at Roseburg on the 30th, 0.24 above the normal. Occasional light rain or snow fell during these days on the northern half of the Pacific coast region.

Areas of Low Pressure.—During the month of March sixteen of these areas have passed over the country comprised within the limits of the Signal Service Weather Maps. Of these six have first appeared on the Pacific coast north of California, six have came from Manitoba or Saskatchewan, one developed in the Upper Mississippi and two in the valley of the Lower Rio Grande. The areas of most marked interest are No. II and No. XV. During the passage of No. II violent storms occurred in the Lake region during the 4th and 5th. In connection with area No. XV there prevailed in the Lower Missouri and Upper Mississippi valleys during the 26th and 27th a succession of violent dust and wind-storms which have rarely been equalled in those districts for duration and violence.

No. I.—This area apparently entered British America north of Washington Territory on the morning of the 1st, during which day rain fell in the north Pacific coast region and in western Montana. Central in Montana on the morning of the 1st, it moved southeast and by midnight had reached the Missouri valley, Breckenridge barometer 0.53 and Yankton barometer 0.51 below the normal. On the morning of 2nd Cautionary Signals were ordered for Indianola and Port Eads. During the afternoon signals were displayed for Lake Michigan. The centre on the morning of the 3rd was in southwestern Minnesota and in the afternoon over Lake Superior. On the morning of the 3rd, Cautionary Signals on the north Carolina coast displayed for high area No. I were continued, and Cautionary Signals were displayed northward along the Atlantic coast to New York, and in the afternoon from New Haven northward to Thatcher's Island, at Smithville, Wilmington and Galveston. At midnight the Cautionary Signals on Lake Michigan were lowered, having been fully justified by velocities of SE. 26 at Grand Haven and S. 27 at Milwaukee. Cautionary Signals were then ordered for the Maine coast. During the day brisk to high southerly winds, with rain, prevailed in the Lake region and on the Atlantic slope. The storm moving eastward, on the

morning of the 4th was central in the lower St. Lawrence valley, and during the day passed eastward through New Brunswick over the Atlantic Ocean. The morning of the 4th all signals on the Atlantic coast were lowered, having been fully justified, except at Eastport, with maximum velocities of 40 SE. at Cape Hatteras, W. 48 at Delaware Breakwater, SW. 36 at Sandy Hook, SE. 40 at Wood's Holl and SW. 29 at Thatcher's Island. The signals in the Gulf of Mexico were lowered at midnight, having been justified, except at Galveston. During the passage of this area the maximum temperatures of the month in the State of Maine occurred..

No. II.—The track of this area was very similar to that of No. I. Appearing in British Columbia at midnight of the 1st, it moved southeastwardly through Montana and Dakota to the Lower Missouri valley where it was central on the morning of the 4th, Omaha and Leavenworth barometers 0.55 below the normal. It thence moved northeastwardly and was central that afternoon in eastern Iowa. Cloudy and threatening weather, with fresh to brisk winds, prevailed in the Lake region. Cautionary Signals were then ordered for Lake Michigan and at midnight were displayed at Sandy Hook and Delaware Breakwater. The storm, central in Michigan at midnight of the 4th, reached Lake Ontario on the morning of the 5th. Its passage was marked by violent winds in Ohio, Michiga : and Indiana, which are elsewhere treated under the heading of local storms. Maximum velocities were reported of 72 miles W. at Toledo, 36 NE. at Alpena, 33 SW. at Cleveland and 40 W. at Columbus. Cautionary Signals were ordered at that time from Cape Hatteras northward to Eastport. At noon they were changed to Cautionary Off-shore from Cape Hatteras to New York and from Wood's Holl to Portland. Cautionary Off-shore Signals were ordered at Savannah and Charleston, and Cautionary from Smithville to Cape Lookout. The Cautionary Signals for Lake Michigan were then lowered having been fully justified by wind velocities of W. 34 at Milwaukee and W. 42 at Grand Haven. Moving eastward the area was central the 5th off the Maine coast, and at midnight southeast of Nova Scotia. All signals on the Atlantic coast were lowered at midnight of the 5th, except from Delaware Breakwater southward to Fort Macon, which were lowered the morning of the 6th. Except at Charleston and Savannah these signals were fully justified ; the following wind velocities being reported: 32 S. at Smithville, 35 SW. at Cape Lookout, 42 SW. at Delaware Breakwater, 36 W. at New Haven, 44 SW. at Thatcher's Island and 35 N. at Eastport. During the passage of this area the maximum temperatures of the month occurred in the Atlantic States (except Maine), in the Lower Lake region, the Ohio valley, Texas and at most stations in the Gulf States.

No. III.—The course of this area was nearly parallel with the tracks of Nos. I and II, except that it was farther northward. Its course from midnight of the 4th to midnight of the 5th was probably southeastward from the coast of British Columbia to Manitoba. During that time cloudy weather, southerly winds, with rain or snow, generally prevailed from Oregon eastward to Dakota. Moving southeastward from Manitoba it was central, with increased pressure, in Minnesota on the morning of the 6th, and in connection with high area No. III, Cautionary Signals were displayed on Lake Michigan. Changing its course to the northeast its centre was over Lake Superior at midnight of the 6th. Cautionary Signals were then ordered for North Carolina and the New Jersey coasts. The afternoon of the 7th the area was in Ontario. Cautionary Signals were then ordered from New York eastward to Wood's Holl, and at midnight the Cautionary Signals were changed to Cautionary Off-shore Signals, and on the following morning, as the storm passed northeastward over the Gulf of St. Lawrence, Cautionary Off-shore Signals were displayed from Newport northward to Portland, and a Cautionary Signal was ordered for Eastport. The signals for Lake Michigan were lowered at midnight of the 7th, having been justified. The signals along the Atlantic coast had already been fully justified, but were all continued as Cautionary Signals until midnight of the 9th, in connection with high area No. IV and low area No. IV .

No. IV.—The pressure in the valley of the Rio Grande decreased during the 5th, and on the morning of the 6th the barometer at Mason was 0.16 below the normal. The area moving northeastward was central at midnight in Indian Territory. A Cautionary Signal was then displayed at Indianola. Moving northeastwardly the area was central afternoon of the 7th in the Ohio valley, and by midnight of that date had passed eastward through Virginia over the Atlantic Ocean. The Cautionary Signals continued along the Atlantic coast from Smithville northward to Wood's Holl during the 7th were fully justified, but were continued from New York to Delaware Breakwater as Cautionary Off-shore, and elsewhere as Cautionary, in connection with low area No. V and high area No. IV. They were fully justified by velocities ranging from 28 to 34 miles E. on the New Jersey coast, and from 26 to 32 miles NE. on the North Carolina coast. The signals on the Texas coast were continued till the 8th in connection with high area No. IV, and are considered in connection therewith.

No. V—appeared in the valley of the Rio Grande at midnight of the 8th and moved thence northeastwardly over the Gulf of Mexico. On the morning of the 9th it was central in Alabama, and during the day moved eastward through Georgia over the Atlantic Ocean. Cautionary Signals were displayed midnight of the 8th at Cedar Keys, Savannah and Charleston, and the signals on the Carolina coast displayed in connection with high area No. IV were continued. The signals as far north as Wilmington were lowered at midnight of the 9th and northward to Cape Henry on the morning of tho 10th. They were all justified, excepting at Charleston and Savannah, by the following wind velocities: Cedar Keys, SW. 28; Fort Macon, NE. 32, and Cape Henry, NE. 40 miles.

No. VI.—This area moved southward along the eastern slope of the Rocky Mountains during the 7th, from Saskatchewan to Montana, where it was central at midnight, Ft. Keogh barometer 0.36 below the nor.

mal. From this point a branch moved southwestwardly through Utah into California and is subsequently described as low area No. VII. The main branch moving southeastward at midnight of the 8th was central in the Lower Missouri valley, Omaha barometer 0.13 below the normal. Cautionary Signals were then ordered for Lake Michigan. On the morning of the 9th this area was central in northwestern Michigan with high area No. IV in the St. Lawrence valley to the eastward and advancing high area No. V to the westward in the Upper Missouri valley. During the day the area moved eastward while cloudy weather, with snow, prevailed in the Lake region. Signals on Lake Michigan were lowered at midnight, having been fully justified by wind velocities of NW. 38 at Milwaukee and W. 32 at Grand Haven. Central, morning of the 10th in the Lower St. Lawrence valley, during the day it moved northeastward over the Gulf of St. Lawrence.

No. VII.—This area was central as a part of No. VI, in Montana midnight of the 7th, its course thence is an unusual one. Moving southwestward it was central in Utah the morning of the 8th and in southern California at midnight; Visalia barometer 0.28 below the normal. At that time in connection with high area No. II high northerly winds prevailed in central California doing considerable damage as has been noted in a description of that area. Changing its course to the southeastward it passed through Arizona on the 9th, New Mexico on the 10th and reached the valley of the lower Rio Grande the afternoon of the 11th; Brownsville, barometer 0.38 below the normal. Cautionary Signals were displayed at Galveston, Port Eads and Cedar Keys during the 10th and the signal ordered at Indianola the previous night was continued. Moving northeastward the area was central in Arkansas at midnight, and on the morning of the 12th in northern Alabama. On the morning of the 12th in connection with high area No. VII, the Cautionary Signals at Port Eads, Galveston and Indianola, were changed to Cautionary Off-shore Signals. The area moving from Alabama southward over the eastern part of the Gulf of Mexico gradually filled up during the 13th. On the morning of that day all signals in the Gulf were lowered, having been justified, except at Galveston; maximum wind velocites: Cedar Keys, N. 35, Indianola, N. 36.

No. VIII.—Advancing southeastward from Manitoba this area was central the morning of the 10th in the Upper Missouri valley, Bismarck barometer 0.23 below the normal. In the afternoon a Cautionary Signal was displayed at Milwaukee, and on the morning of the 11th at Grand Haven and Ludington. At the latter date the area, with increasing pressure, was over Lake Michigan; thence moving northeastward, with but little energy, it passed over the Gulf of St. Lawrence during the 12th. The signals on Lake Michigan, continued in connection with high area No. VII, were lowered the morning of the 14th, having been justified by a wind velocity of 29 W. at Grand Haven. No other signals were displayed, nor were any other high winds reported in connection with this area.

No. IX.—During the 13th the pressure fell sharply in the Upper Mississippi valley, and at midnight a well-defined area of low pressure, accompanied by brisk, variable winds and snow, covered the Upper Lake region. Moving northeastward the area was central the afternoon of the 14th in the St. Lawrence valley, and during the night it withdrew northeastward through Nova Scotia over the Atlantic Ocean. No signals were displayed during the passage of this area and no high winds have been reported

No. X.—At midnight of the 14th a sharp barometric fall occurred in the Western Gulf States, and on the morning of the 15th an area of low pressure was central in Louisiana; New Orleans and Mobile barometers 0.14 below the normal. It was central that afternoon in Alabama. Cautionary Signals were then displayed at Port Eads, Cedar Keys and from Cape Henry southward to Fort Macon. Moving northeastward the area, with decreasing pressure, was central at midnight in Tennessee; Montgomery barometer 0.23 below the normal. Cautionary Signals were then ordered at Milwaukee, Toledo, Sandusky and for the New Jersey coast, and on the following morning like signals were displayed for the rest of Lake Erie, the southern half of New England and Wood's Holl. Central the morning of the 16th in Kentucky, it passed off the New Jersey coast over the Atlantic that da.. During the day the signals on Lakes Michigan and Erie were lowered, and those along the New Jersey coast were changed to Off-shore, in connection with high area No. VII. The signals along the Atlantic coast were all justified, by north to east winds, with velocities ranging from 26 miles at Thatcher's Island to 30 miles at Sandy Hook. The signals on Lakes Erie and Michigan were but partly justified. Brisk northeast wind, with heavy snow, prevailed on these lakes, and wind velocities of NE. 27 at Grand Haven and NW. 37 at Sandusky were reported.

No. XI.—This area appeared on the Oregon coast on the morning of the 16th. During the 16th and 17th it moved southeastward through Colorado and Utah to Kansas, where it was central at midnight of the latter date; Dodge City barometer 0.22 below the normal. On the morning of the 18th it reached the Lower Missouri valley and moving eastward was central at midnight in Ohio; Louisville and Indianapolis, barometers 0.21 below the normal. At this time a barometric trough extended from the Lake region southward to the Gulf, and a subsidiary area—in connection with which Cautionary Signals had that morning been displayed at Indianola and Galveston—was central in Alabama. Cautionary Signals were then ordered from Kittyhawk southward to Fort Macon, and the signals on the Texas coast—not justified—were lowered. On the morning of the 19th the area was central in Virginia and during the day passed northeastward over the Atlantic Ocean. Cautionary Signals were ordered that morning from Norfolk northward to Wood's Holl. The signals along the New Jersey coast were changed that afternoon to Off-shore. All signals on the Atlantic coast were lowered at midnight, except at Newport and Wood's Holl where they remained displayed until the morning of the 20th. These signals were generally justified by velocities varying from S. 26 at Thatcher's Island to 28 NW. at Cape Lookout, 36 NW. at Chincoteague and 44 NW. at Cape Henry.

No. XII.—This area first appeared on the morning of the 20th northward of Lake Huron. At that time brisk west to south winds prevailed in the Lake region, with maximum velocities of 26 and 28 miles on Lake Michigan. It was central in the afternoon in Ontario; Toronto barometer 0.24 below the normal. By an easterly course it reached Vermont at midnight. During the day brisk to high westerly winds, with snow prevailed on Lake Huron and in the Lower Lake region. The following maximum wind velocities were reported: 32 to 42 W. on Lake Huron, 25 NW. to 37 W. on Lake Erie, from 32 to 40 NW. on Lake Ontario. No signals were displayed in connection with this area in the Lake region. At midnight of the 20th Cautionary Off-shore Signals were displayed from Chincoteague northward along the Atlantic coast to Eastport. By the morning of the 21st this area had passed southeast through Maine over the Atlantic Ocean. The signals from Eastport southward to Chincoteague were lowered that afternoon. These signals, except at Eastport, were fully justified, the following wind velocities having been reported: Thatcher's Island, NW. 30; Wood's Holl, NW. 44; Sandy Hook, NW. 40; Chincoteague, NW. 32.

No. XIII—passed too far to the northward of the limits of the Signal Service stations to permit its course to be accurately charted. It was apparently central in the northern part of Manitoba the morning of the 20th. Passing through the region to the north of the Upper Lakes during the 21st it moved easterly over the Gulf of St. Lawrence during the 22nd. During the 21st maximum velocities ranging from 26 to 29 miles were reported from several stations on Lakes Superior, Michigan and Huron. In the afternoon Cautionary Signals were ordered for Lake Erie which, not justified in connection with this area, were continued until midnight of the 23rd in connection with advancing low area No. XIV.

No. XIV.—This area was central in Manitoba on the morning of the 2nd. During the afternoon Cautionary Signals were ordered for Lakes Superior and Michigan and the signals ordered on Lake Erie in connection with the previous area were continued. Moving eastward it was central at midnight over Lake Superior and on the morning of the 23rd was to the northward of Lake Huron. At that time Cautionary Signals were ordered for the New Jersey coast and Lakes Ontario and Huron, except at Alpena, where signals had been displayed the midnight previous. In the afternoon the storm was central in Ontario, and at midnight in northern New York. That afternoon Cautionary Signals were displayed from Cape Hatteras to Cape Henry and from New York northward along the Atlantic coast to Eastport. The signals along the New Jersey coast having been fully justified as Cautionary Signals in connection with this area were changed to Cautionary Off-shore Signals for advancing high area No. X, and a similar change of signals was made from New York northward to Portland at midnight, and at Eastport the following morning. The signals for the entire Upper Lake region and at Sandusky and Toledo on Lake Erie were lowered at midnight, having been fully justified by the following wind velocities: Duluth, 32 SW.; Marquette, 33 NW.; Escanaba, Milwaukee and Grand Haven, 36 NW.; Alpena and Detroit, 35 NW., and Sandusky, 50 NW. On the morning of the 24th the area was central, with diminishing pressure in Maine; Portland barometer 0.52 below the normal. Warnings were then sent for Pictou, Halifax, St. John's and Yarmouth, and, in connection with advancing high area No. X, Cautionary Signals were displayed at Norfolk, and from Cape Lookout southward along the Alantic coast to Smithville. The area moving slowly eastward during the 24th through Nova Scotia passed over the Atlantic ocean during the 25th. The signals at Cleveland, Erie and at stations on Lake Ontario were lowered the afternoon of the 24th, having been fully justified. All the signals along the Atlantic coast were lowered during the 25th, having been justified by violent northerly gales. The following are the highest wind velocities reported: Eastport, 52 NE.; Thatcher's Island, 62 NW.; Wood's Holl, 54 NW.; Sandy Hook and Cape Henry, 56 NW.; Kittyhawk, 44 N.

No. XV.—This area appeared in British Columbia the afternoon of the 24th; Portland barometer 0.46 and Fort Benton barometer 0.45 below the normal. Moving southeastward it was in Idaho the morning of the 25th, and by an easterly path was central in Nebraska the afternoon of the 26th; Omaha barometer 0.75 below the normal. At that time the pressure in the entire Missouri and Upper Mississippi valleys, ranged from 0.40 to 0.75 below the normal. Cautionary Signals were displayed on that morning for Lakes Erie and Huron, and the signals displayed on the preceding day, in connection with high area No. X, for Lakes Michigan and Superior, were continued. In the afternoon Cautionary Signals were displayed at Kittyhawk and Cape Henry and for the New Jersey and Texas coasts. At midnight the area was central in Iowa, at which time the pressure over the greater part of the Lower Missouri and Upper Mississippi valleys was 0.60 below the normal. At that time brisk easterly winds prevailed in the entire Lake region and Mississippi valley generally accompanied by rain, and brisk northerly winds from the Missouri valley westward. On the morning of the 27th the area was central in eastern Iowa—Davenport barometer 1.04 below the normal—in the afternoon in northern Illinois, and at midnight in northwestern Ohio. During the day violent wind-storms, which are elsewhere treated in detail, occurred in the Upper Mississippi and Lower Missouri valleys and in the Upper Lake region. Westward from the Mississippi valley to the Rocky Mountain Slope, but little or no rain falling, remarkable dust-storms prevailed. During the day the following barometer readings occurred, being the lowest on record since the Signal Service stations were opened: St. Louis, 29.16; Davenport, 28.87; Keokuk, 28.95; Milwaukee, 28.94; Dubuque, 28.98. On the morning of that day Cautionary Off-shore Signals were ordered for the Texas coast, at Port Eads and New Orleans, and Cautionary Signals were ordered for the remaining Gulf stations, for Lake Ontario and at all stations along the Atlantic coast, where Cautionary signals were not then displayed, except in Maine where they were hoisted later in the day. On the morning

of the 28th a trough of low pressure extended from Lake Erie southeastward to the New Jersey coast. At that time the pressure over the Lower Lake region, New England, the Middle Atlantic States and North Carolina ranged from 0.50 to 0.70 below the normal. By afternoon the area had passed southeastward off the Virginia coast. The signals in the Lake region were all lowered during the day, having been fully justified, maximum wind velocities having been reported at Duluth, 44 NE.; Milwaukee, 40 E.; Alpena, 35 E.; Toledo 48 SW.; Oswego, 28 NE. The signals from Wood's Holl southward along the Atlantic coast to Cape Henry, from Charleston to Jacksonville and at all Gulf stations were lowered in the morning, and from Boston northward to Eastport at midnight of the 28th, these signals were fully justified; the following maximum wind velocities having been reported Indianola, 40 S.; Cedar Keys, 42 SW.; Jacksonville and Charleston, 29, SW.; Cape Hatteras, 56 SW.; Chincoteague, 49 SE.; New York and Eastport, 30 NE.; Boston, 40 E. Brisk easterly winds continued on the New Jersey coast during the day, and the Cautionary Signals lowered: the morning of the 28th were followed at midnight by Cautionary Off-shore Signals, from Sandy Hook southward to Cape Henry, and at the same time on the North Carolina coast; the Cautionary Signals were lowered at Smithville and Wilmington, and changed to Cautionary Off-shore Signals from Macon to Kittyhawk. These signals were continued until the 31st in connection with high area No. XII. After leaving the North Carolina coast on the 28th this storm evidently moved northeastward inducing, in connection with high area No. XII., the brisk to high northerly winds, which continued to prevail along the Maine and Massachusetts coasts from the 28th until midnight of the 31st.

No. XVI.—This area appeared on the coast of British Columbia, midnight of the 26th, and moving slowly southeastward reached Utah the morning of the 29th and Kansas the 30th, Dodge City barometer at midnight 0.36 below the normal; changing its course to the northeast, it was central the morning of the 31st in the Lower Missouri valley, Omaha barometer 0.35 below the normal. Cautionary Signals were then ordered for Grand Haven, Milwaukee and sections 1 and 3. Continuing its northeasterly course, by midnight of the 31st it passed into the region north of Lake Superior. The Cautionary Signals on Lake Michigan were lowered April 1st; justified by velocities of 26 E. and 40 W.

INTERNATIONAL METEOROLOGY.

Three International charts, Nos. IV, V and VI, accompany the present *Review*. They exhibit the meteorological conditions of the northern hemisphere and portions of the southern hemisphere for the months of *August*, 1878, and *February*, 1880. No. IV indicates the probable course of five of the principal storm-areas occurring over the North Atlantic Ocean during the month of *February*, 1880. Two of these, Nos. I and II, appear to have passed in a northeasterly course after arriving at the 40th meridian, and to have produced southerly gales along the British coasts in two or three days after leaving Newfoundland. The latter of these was encountered by the *Hibernian* on the 10th and 11th; this vessel reports on the 10th in 53° N. 28° W. heavy SE. gale, with heavy rain; 11th, 53° N. 30° W., barometer 28.15, terrific hurricane from SE. to NW. No. III appears to have slowly developed during the 8th in the southwest quadrant of area No. I; on the 9th and 10th it was encountered by the ship *Iron Cross* in about 40° N. 16° W. This vessel reports "on the 9th, at 4 p. m., in 42° N. 16° W., barometer 29.45, wind veering from SSW. to NW; at 11 p. m. a heavy NW. gale commenced, which reached its maximum force about 2 a. m. of the 10th, squalls of nearly hurricane force of 15 minutes duration occurring about every 30 minutes; the barometer rose from 29.48 at 8 p. m. of the 9th to 30.51 at 8 a. m. of the 11th, when the vessel was in 37° N. 17° W." No. IV appeared over mid-ocean on the 12th, and from the 13th to the 18th remained, as an extensive area of remarkably low pressure, over the eastern half of the Atlantic. Steamers *Sardinian* and *Leipsig* report the following, barometer error of former vessel being about —0.35. of latter quite, small:

1880.	*Steamship Sardinian.*				*Steamship Leipsig.*			
	Lat.	Long.	Barometer.	Wind.	Lat.	Long.	Barometer.	Wind.
February 15..	54° N.	20° W.	28.20	SSE. 9.	50° N.	12° W.	28.92	SW. 6.
" 16..	53° N.	25° W.	28.00	ENE. 6.	49° N.	16° W.	28.86	NW. 5.
" 17..	51° N.	32° W.	28.08	NNE. 6.	49° N.	19° W.	28.74	WNW. 7.
" 18..	49° N.	40° W.	28.75	N. 7.	49° N.	23° W.	28.77	W. 6.

The following remarks accompany the observations forwarded by the *Sardinian*:—"On February 15th, 16th and 17th, the barometer read from 28.00 to 28.50, the wind, at times, gaining a force of 7 or 8 (Beaufort) to light and variable, and backing twice round from ESE. through NE. and N. to NW. and W.; on the 19th the barometer rose with a steady wind from N., force 7, 8, 6 and 4, thus restoring the equilibrium without any great force of wind. The sea, during this time, was very confused." No. V. developed during the 15th on the coast of North Carolina, and on the 16th and 17th moved rapidly eastward south of Nova Scotia. On the 15th it was encountered by Brig *George*, in 38° 26′ N. 72° 48′ W., which vessel reports as follows:—"On the morning of the 15th, from 12 midnight to 2 a. m., wind from NE. to E., moderate, but having the appearance of rain. From that time up to time of observation, (7:35 a. m., Washington mean time) baffling winds from ENE. to ESE. and even to SE., with heavy squalls of rain; at 10 a. m. wind

commenced to back to NNE. and set in in good earnest; at 2 p. m. took in foresail and reefed mainsail; at 4 p. m., wind N. heavy—12 midnight, NW. wind with heavy sea." On this chart will also be found the probable course of two storms encountered by the S. S. Gaelic over the North Pacific Ocean on December 22nd and 26th, 1879, respectively. During the storm of the 26th the barometer fell to 29.15, the gale commenced at SE. and veered to SW. and N., attaining a force of 11 (Beaufort) with a mountainous sea.

Chart No. V shows by isobaric and isothermal lines, the mean pressure and temperature, and, by small arrows, the prevailing direction of the wind, at 7:25 a. m., Washington mean time, over the northern and portions of the southern hemisphere for the month of August, 1878. The barometer observations have been corrected for temperature and reduced to sea level. At stations lying outside the area included within the lines and for those in the southern hemisphere the means are shown by figures indicating the temperature in degrees, Fahr., and the pressure in English inches. As compared with the preceding month (July, 1878) the pressure over the ocean-areas, (especially over the eastern portions) is decidedly lower: thus at St. Michael's and St. Paul's Island, Behring's Sea, the mean pressure fell from 29.78 and 29.82 to 29.69 and 29.78 while the means of the observations between 30 and 50 N. are also lower. Over the Atlantic the region of 30.30 entirely disappeared, the area of 30.10 which during July covered the greater part of the North Atlantic and the northeastern margin of which extended to Ireland and Land's End, diminished so that in August it was included between the parallels of 20 and 40 N. The area of low pressure over the northern portion of the North Atlantic, which during July was probably central to the north of Godthaab and Stykkisholm, is found during August central between the parallels of 50 and 60 N., and probably about 20 W. The isobar 29.80 includes the greater part of the ocean between 48 and 51 N., and 30 and 10 W., the British Isles, the North Sea and portions of Denmark, Sweden and Norway. Over Western Europe and Asia the means show a general increase of pressure, and during the latter part of the month (August, 1878) northerly winds set in along the coast of China. The monthly rainfalls reported by the co-operating stations in Hindostan show an increase in amount at all stations, except Bombay, Poona, Allahabad and Chittagong; increase, 16.13 inches at Decsa and 6.27 at Goalpara. At Bombay the decrease is 28.15 inches.

On Chart No. VI are traced the paths of thirty of the principal storm-areas, which traversed the northern hemisphere during the month of *August* 1878. The general distribution of these tracks corresponds to that of low pressures, as shown on chart No. V. Among the most notable storms of the month the following may be mentioned. No. I, typhoon along the coast of China, from July 30th to August 1st; the lowest pressures were experienced at Nagasaki on the 2nd, with S. to WSW. winds, and at Tokio on the 3rd, with SSW. and SW. winds. At these stations the greatest daily velocities of the month were recorded during the passage of this area, namely, Nagasaki, on the 2nd, 506 miles and Tokio, on the 3rd, 260 miles; at the former station on the 1st a rainfall of 7.45 inches was recorded with SE. and S. winds. On the 5th, S. S. *Peking* in 35 N. 157 W. reports barometer 29.70, wind SSW., 41 miles, veering on the 6th, to N. by W. 25 miles. No. IX was accompanied by SW. gales along the coast of Alaska from the 1st to the 4th, the maximum velocity of the month, SW. 74 miles per hour, being registered at St. Michael's on the 2nd. No. XII, described in the *Monthly Weather Review* for August, 1878, as low area No. IV, was accompanied in its passage over the eastern portion of the United States by exceedingly severe thunder-storms, and by a destructive tornado at Wallingford, Conn. No. XVI, described as low area No. VIII, in the *Review* for August, 1878, which developed into a hurricane over the western portion of the Gulf of Mexico on the 16th and 17th. No. XVII, (No. VI, August *Review*,) accompanied by severe gales on the 19th and 20th, from 35 N. to the Gulf of St. Lawrence, and between the meridians of 55 and 61 W. No. XX was quite severe in the region of Hudson's Bay and Davis Straits, a vessel being driven ashore on the west coast of Hudson Bay during a heavy NE. gale on the 23rd, and on the 25th meteorological observations on board the Schr. Florence in Davis Straits were omitted on account of "heavy storm." No. XXI over the East Atlantic on the 18th and 19th. No. XXV over the North Pacific on the 25th. No. XXVI, which progressed very slowly as a hurricane of great severity from the Bahamas to the Bermudas; it was encountered on the 25th in 26 N. 76 W., on the 26th, 29 N. 71 W., 27th, in 31 N. 71 W., on the 28th it passed over the Bermudas and on the 29th was encountered in 36° N., 55° W.

TEMPERATURE OF THE AIR.

The mean temperatures for March, 1880, are shown by the isothermal lines upon chart No. II. As is shown by the table of average temperatures on that chart the temperature was above the normal in all districts from the Mississippi valley eastward to the Atlantic ocean, except New England, St. Lawrence valley and Canadian maritime stations. In the Plateau and Rocky mountain districts, Missouri and Red River of the North valleys and on the Pacific coast the temperature was below the normal. The greatest excess of temperature prevailed in Florida, and the greatest deficiencies are reported from the Canadian maritime stations, 5°.9 below; Red River of the North valley, 5°.1 below; Portland, Or., 6°.6 below; North Rocky Mountain slope, 7°.3 below. The temperature has been unusually low from the northern half of the Pacific coast region eastward to the Red River of the North valley. The table of comparative temperatures for the several districts is printed on the right side of chart No. II.

Maximum Temperatures.—Maine: 56° at Portland. *New Hampshire:* 37° at Mt. Washington and 57° at *Dunbarton. *Vermont:* 53° at Burlington and 63° at *Charlotte. *Massachusetts:* 72° at Boston. *Rhode Island*: 60° at Newport. *Connecticut:* 69° at New Haven. *New York:* 70° at New York and 58° at Oswego. *New Jersey:* 73° at Barnegat; 74° at *Trenton, *Vineland and *New Lisbon. *Pennsylvania:* 75°

at Philadelphia and 69° at *Catawissa. *Delaware:* 73° at Delaware Breakwater. *Maryland:* 76° at Baltimore and *Emmittsburg. *District of Columbia:* 79° at Washington. *Virginia:* 81° at Norfolk and 77° at Lynchburg. *West Virginia:* 71° at Morgantown. *North Carolina:* 82° at Wilmington, 79° at Charlotte and 83° at *Weldon. *South Carolina:* 80° at Charleston and 82° at *Aiken. *Georgia:* 85° at Savannah and 84° at Augusta. *Florida:* 87° at Key West, 79° at Pensacola and 93° at *Houston. *Alabama:* 85° at Montgomery. *Mississippi:* 85° at Vicksburg. *Louisiana:* 81° at New Orleans and 85° at *Point Pleasant. *Texas:* 99° at Eagle Pass, 97° at Rio Grande City, 87° at Stockton, 84° at Denison, 86° at Fort Elliott 80° at Indianola and 104° at *Ft. Ringgold. *Ohio:* 70° at Cincinnati and 63° at Cleveland. *Kentucky:* 77° at Louisville. *Tennessee:* 76° at Memphis and Knoxville. *Arkansas:* 78° at Little Rock and *Mount Ida. *Michigan:* 57° at Port Huron and 48° at Escanaba. *Indiana:* 70° at Indianapolis and 76° at *Laconia. *Illinois:* 71° at Cairo, 60° at Chicago and 75° at *Anna. *Missouri:* 76° at St. Louis and 84° at *Corning. *Kansas:* 85° at Dodge City and *Wellington, 76° at Leavenworth. *Wisconsin:* 60° at La Crosse. *Iowa:* 80° at Des Moines and *Logan. *Nebraska:* 80° at North Platte and 79° at Omaha, 84° at *Howard. *Indian Territory:* 88° at Ft. Sill and 78° at Ft. Gibson. *Minnesota:* 62° at St. Paul and 55° at Duluth, 54° at Breckenridge. *Dakota:* 68° at Ft. Buford and Yankton, 45° at Pembina and 72° at *Olivet and *Morriston. *Colorado:* 73° at Denver and 25° at Pike's Peak, 70° at *Ft. Collins. *New Mexico:* 81° at La Mesilla and 63° at Santa Fe. *Wyoming:* 69° at Cheyenne. *Utah:* 62° at Salt Lake City and 51° at *Coalville. *Nevada:* 84° at Tulasco Wells, 65° at Winnemucca and 56° at Pioche. *Arizona:* 87° at Tucson, 78° at Ft. Verde and 72° at Ft. Apache. *Idaho:* 64° at Boise City. *Montana:* 72° at Ft. Keogh and 68° at Ft. Benton. *California:* 88° at *Livermore, 78° at Red Bluff, 69° at San Diego. *Oregon:* 58° at Portland and 69° at Umatilla. *Washington Territory:* 58° at Olympia.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Minimum Temperatures.—Maine: —1° at Eastport and —5° at *Orono. *New Hampshire:* —13° at Mt. Washington and —1° at *Dunbarton. *Vermont:* —1° at Burlington and —4° at *Lunenburg and *Newport. *Massachusetts:* 12° at Boston and Springfield, and 2° at *South Lee. *Rhode Island:* 14° at Newport. *Connecticut:* 12° at New Haven and 10° at *Southington. *New York:* 16° at New York and 8° at Oswego, 1° at *Plattsburg Barracks and —2° at *Madison Barracks. *New Jersey:* 18° at Barnegat and Atlantic City, 13° at *Newark. *Pennsylvania:* 18° at Pittsburgh and 6° at *Franklin. *Delaware:* 25° at Delaware Breakwater and 22° at *Dover. *Maryland:* 22° at Baltimore and 13° at *Owings' Mills. *District of Columbia:* 21° at Washington. *Virginia:* 27° at Norfolk, 30° at Lynchburg and 18° at *Mt. Solon. *West Virginia:* 20° at Morgantown and *Helvetia. *North Carolina:* 33° at Charlotte and 31° at Kittyhawk, 25° at *Franklin and *Highlands. *South Carolina:* 40° at Charleston and 37° at *Aiken. *Georgia:* 43° at Savannah, 35° at Augusta and 34° at *Gainesville, 32° at *McPherson Barracks. *Florida:* 63° at Key West and 40° at Pensacola, 36° at *Fort Barrancas. *Alabama:* 35° at Mobile and Montgomery, and 34° at *Green Springs. *Mississippi:* 35° at Vicksburg and 34° at *Fayette. *Louisiana:* 42° at New Orleans and 34° at Shreveport, 38° at *Point Pleasant. *Texas:* 32° at Indianola and Rio Grande City, 24° at Eagle Pass, 15° at Stockton, 14° at Denison and —2° at Fort Elliott. *Ohio:* 28° at Cincinnati and 15° at Cleveland, 8° at *North Lewisburg. *Kentucky:* 27° at Louisville. *Tennessee:* 29° at Nashville and 28° at *Clarksville and *Ashwood. *Arkansas:* 32° at Little Rock and 28° at *Mt. Ida. *Michigan:* —16° at Escanaba, —8° at Alpena, 11° at Detroit and Port Huron. *Indiana:* 21° at Indianapolis and 18° at *Wabash. *Illinois:* 28° at Cairo, 19° at Chicago and 10° at *Anna. *Missouri:* 23° at St. Louis and —4° at *Oregon. *Kansas:* —8° at Dodge City and 4° at Leavenworth, —4° at *Creswell. *Wisconsin:* —1° at La Crosse, 10° at Milwaukee and —12° at *Neillsville. *Iowa:* —3° at Des Moines, —21° at *Vail, 19° at *Glenwood and 18° at *Logan. *Nebraska:* —21° at North Platte and —7° at Omaha. *Indian Territory:* 10° at Fort Sill. *Minnesota:* —30° at Breckenridge, —18° at Duluth and —7° at St. Paul. *Dakota:* —31° at Pembina, —23° at Forts Buford and Stevenson and —16° at Yankton. *Colorado:* —10° at Denver, —14° at Pike's Peak and —12° at *Fort Collins. *New Mexico:* 24° at La Mesilla and 0° at Santa Fe. *Wyoming:* —17° at Cheyenne and —42° at *Ft. Fred Steele, and —34° at *Ft. Fetterman. *Utah:* 5° at Salt Lake City and —20° at *Coalville. *Nevada:* 2° at Winnemucca and 5° at Pioche, 0° at *Carson City and 2° at *Tulasco Wells. *Arizona:* 30° at Florence and Phœnix, 11° at Prescott and 18° at Ft. Apache. *Idaho:* 10° at Boise City. *Montana:* —24° at Fort Keogh, —18° at Fort Benton and —22° at Virginia City. *California:* 19° at Campo, 39° at San Diego and San Francisco, 31° at Visalia, 28° at Red Bluff, 15° at *Ft. Bidwell and —10° at *Truckee. *Oregon:* 12° at Umatilla, 19° at Roseburg, 25° at Portland and —4° at *Ft. Harney. *Washington Territory:* 23° at Olympia.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Ranges of Temperatures at Signal Service Stations.—The *monthly ranges* will appear from an examination of the maxima and minima just given. The greatest *daily ranges* vary in New England from 21° at Woods Holl, 27° at Springfield, Mass., to 51° at Eastport and 42° on Mt. Washington. For Middle Atlantic States from 23° at Sandy Hook and New York, 25° at Albany, to 32° at Norfolk. South Atlantic States, 16° at Portsmouth, N. C., 26° at Atlanta, 28° at Jacksonville to 32° at Augusta. East Gulf States, 13° at Key West, 21° at Cedar Keys to 26° at Pensacola and 33° at Montgomery. West Gulf States, 19° at Galveston, 25° at Little Rock, 27° at Vicksburg to 37° at Corsicana. Tennessee and Ohio valley, 22° at Cairo to 29° at Morgantown and Nashville, and 36° at Knoxville. Lower Lake region, 24° at Buffalo to 27° at Detroit and Rochester, and 30° at Oswego. Upper Lake region, 26° at Chicago, 32° at Port Huron, to 35° at Duluth and 50° at Alpena. Upper Mississippi valley, 24° at Springfield, Ill., 27° at Davenport to 36° at St. Paul and 38° at Des Moines. Red River of the North valley, 35° at Pembina

and 43° at Breckenridge. Missouri valley, 32° at Leavenworth, 39° at Yankton and Bismarck to 43° at Ft. Buford. Texas, 30° at Denison and Rio Grande City to 45° at Concho. Eastern Rocky Mountain slope, 35° at Ft. Gibson to 44° at Dodge City, 49° at Ft. Eliott and 52° at North Platte. Middle Plateau District, 29° at Pioche, 32° at Boise City and Salt Lake City, to 42° at Winnemucca. California, 20° at San Francisco, 30° at Sacramento and Visalia to 33° at Los Angeles and 37° at Red Bluff.

Frost—has generally prevailed to the 31st along the entire Rocky Mountain Slope southward to latitude 35° and eastward to the Atlantic ocean; southward of that parallel the following cases are reported: Near Mayport, Fla., light on the 30th; Savannah, Ga., light on the 30th and 31st, slightly injuring plants in low places; Augusta, Ga., 25th, 26th, 30th, 31st, heavy frost, damaging gardens; Clarksville, Tex., 14th to 17th, materially injuring corn, fruit and garden vegetables; 14th to 17th, New Ulm and Austin, Tex.; Mesquite, 13th to 15th, killed corn planted in February, destroyed all early fruits; Melissa, Tex., 14th, 15th, gardens injured; Aiken, S. C., 31st; Mississippi, 17th, near Fayette; Quitman, Ga., 31st, light on low grounds; Gainesville, Ga., 17th, 23rd, 24th, and on 30th, 31st, killing beans and tomato tops: Houston, Fla., 29th, 30th; Green Spring, Ala., 17th, 30th. On the Pacific coast frost was frequent to end of month in the northern half—in California it has been reported as follows: Salinas City, frequent; Mt. St. Helena, 4th, (8th, hardy orange trees killed to the ground, other trees seriously injured;) Lompoc, frequent. Pt. San José, 13th, 15th; Caliente, 25th, freezing Eucalypti trees; at Charleston, S. C., 30th, slightly injuring garden vegetables; at Charlotte, N. C., 31st, injuring fruit trees and vegetables; Atlanta, Ga., 17th, 29th; Texas, Fredericksburg, 10th to 19th, killing all vegetables and injuring wheat badly; Boerne, 14th to 16th, very severe, doing considerable damage to vegetation; San Antonio, 16th, seriously damaging fruit and crops; Uvalde, 15th; Brackettsville, 16th, killing all vegetables; Pilot Point, 15th, damaging vegetables and fruit; Concho, 16th; Castroville, 13th, 16th, injuring fruit and crops; Montgomery, Ala., 29th, 30th, in country near; Little Rock, Ark., 17th; Indianola, Tex., 15th, 16th.

Ice—was general north of parallel 37°. In North Carolina, at Weldon, 23rd; Lenoir, 25th, 31st Statesville, 25th, 30th; Charlotte, 30th; in Tennessee, at Ashwood, 25th; Texas, Melissa, 14th, 15th; Austin; 14th to 17th; Castroville, 15th; San Antonio, 16th, ½ inch thick. California: Pt. San José, 13th; San Francisco, 4th, sidewalks frozen, 12th, 29th; Sacramento, 15th; Los Angeles, 16th. Georgia: Augusta, 31st.

PRECIPITATION.

The general distribution of the rain-fall, including melted snow, for March, 1880, is illustrated upon chart No. III, as accurately as possible from about 500 reports. This chart shows the area of maximum precipitation over Tennessee, northern Mississippi, Alabama and northwestern Georgia. The minimum precipitation in amounts less than one inch fell over the Plateau, the Rocky Mountain districts, a portion of the central Missouri and the greater part of the Missouri valley. In the left-hand corner of the same chart will be found a table of average rain-falls for the month of March. Large excesses over the average for the present month are reported from the Gulf States and Tennessee, and a slight excess from the Middle Atlantic States, and the South Pacific coast region. From all other districts differences are reported, being small except in New England, Lower Missouri valley, the North and Middle Pacific coast regions.

Unusually Heavy Rains.—2nd, Denison, Tex., 2.01 inches in 10 hours and 20 minutes; Messilla, Tex., 2.00 in. in 14 hours. 3rd, Memphis, 1.28 in. in 8 hours; Little Rock, Ark., 2.15 in. in 8 hours. 3rd, Franklin, N. C., 2.60 in. in 22 hours; Chattanooga, Tenn., 2.17 in. in 16 hours. 4th, Highlands, N. C., 2.70 in. in 21 hours; Duluth, 0.98 in. (melted snow) in 4 hours and 15 minutes. 7th, Austin, Tenn., 2.18 in. in 11 hours. 8th, New Orleans, 2.81 in. in 8 hours; Galveston, 1.24 in. in 8 hours; Cape Henry, Va., 1.02 in. in 8 hours; Fayette, Miss., 2.80 in. 9th, Gainesville, Ga., 8th, 9th, 2.65 in. in 22 hours; Mobile, 3.49 in. in 8 hours; Montgomery, 1.34 in. in 8 hours; Charlotte, N. C., 1.69 in. in 8 hours. 10th, Point Pleasant, La., 2.51 in.; Green Springs, Ala., 10th, 11th, 1.97 in. in 18 hours; Forsyth, Ga., 10th, 11th, 3.10 in. in 25 hours. 11th, Little Rock, Ark., 2.11 in. in 16 hours; Corsicana, Tex., 1.58 in. in 8 hours; Vicksburg, 10th, 11th, 2.27 in. in 16 hours; Augusta, 1.53 in. in 8 hours; Denison, Tex., 1.20 in. in 8 hours; Point Pleasant, La., 3.00 in.; Mt. Ida, Ark., 3.20 in. in 22 hours; New Ulm, Tex., 10th, 11th, 3.75 in. Atlanta, 1.02 inches in 8 hours; Melissa, Tex., 2.00 in. in 9 hours; 11th, 12th, Statesville, N. C., 3.10 in. in 18 hours; Ashwood, Tenn., 2.75 in. in 24 hours. 12th, Nashville, 2.78 in. in 16 hours; Memphis, 2.75 in. in 8 hours; Atlanta, 1.13 in. in 8 hours; Austin, Tenn., 2.74 in.; Gainesville, Ga., 13th to 16th, 5.72 in. in 82 hours. 13th, Montgomery, 1.52 in. in 8 hours; Franklin, N. C., 14th to 16th 4.10 in. 14th, Ft. Barrancas, Fla., 2.48 in. in 9 hours. 15th, Chattanooga, 1.83 in. in 8 hours; Knoxville, 1.05 in. in 8 hours; Vicksburg, (14th, 15th,) 4.63 in.; Pensacola, Fla., 1.25 in. in 7 hours; Point Pleasant, La., (14th, 15th,) 5.01 in. in 37 hours; Austin, Tenn., 2.80 in. 16th, Highlands, N. C., 2.55 in.; Montgomery, Ala., 1.67 in. in 6 hours; Pensacola, Fla., 1.64 in. in 6 hours and 20 minutes; Green Springs, Ala., 14th to 16th, 4.95 in.; Ft. Barrancas, Fla., 2.09 in. in 10 hours; Atlanta, 1.32 in. in 8 hours. 18th, Point Pleasant, La., 2.00 in. in 8 hours; Shreveport, 1.40 in. in 6 hours; Fayette, Miss., 2.10 in. 19th, Forsyth, Ga., 2.90 in. in 8 hours; Augusta, 1.71 in. in 6 hours; Smithville, 1.22 in. in 8 hours; Chincoteague, Va., 1.43 in. in 8 hours; Cape Lookout, N. C., 1.73 in. in 8 hours; Portsmouth, N. C., 1.82 in. in 6 and one-half hours. 21st, New Ulm, Texas, 2 50 in. in 12 hours; Galveston, 1.70 in. in 8 hours; Castroville, Tex., 1.18 in. in 14 hours. 26th, New Corydon, Ind., 26th, 27th, 2.29 in. in 17 hours; Fort Leavenworth, Kan., 1.60 in. in 6 and one-half hours. 27th, Cleveland, Ohio, 0.50 in. in 12 minutes; Detroit, 1.20 in. in 8 hours; Indianapolis, 2.27 in.; Chincoteague, Va., 1.43 in. in 8 hours; 31st, Denison, Tex., 1.10 in. in 4 hours.

Largest Monthly Rain-falls, including melted snow.—Point Pleasant, La., 13.16 in.: McPherson Barracks, Ga., 12.46 in.; Franklin, N. C., 12.40 in.; Chattanooga, Tenn., 12.16 in.; Highlands, N. C., 12.00 in.; Atlanta, Ga., 11.87 in.; Gainesville, Ga., 11.75 in.; Murphy, N. C., 11.70 in.; Vicksburg, Miss., 11.23 in.; Green Springs, Ala., 10.76 in.; Cape Henry, Va., 10.72 in.; Austin, Tenn., 10.38 in.; Forsyth, Ga., 10.14 in.; Statesville, N. C., 9.90 in.; Charlotte, N. C., 9.57 in.; Princeton, Cal., 9.50 in.; Mobile, Ala., 9.41 in.; Montgomery, Ala., 9.26 in.; New Ulm, Tex., 9.13 in.; Memphis, Tenn., 8.82 in.; Fayette, Miss., 8.60 in.; Knoxville, Tenn., 8.59 in.; Ashwood, Tenn., 8.50 in.; Nashville, Tenn., 8.16 in.

Smallest Monthly Rain-falls, including melted snow.—Fort Abraham Lincoln, Dak., and Wickenburg, Ariz., trace; Fort Wallace, Kan., 0.02 in.; Punta Rassa, Fla., 0.03 in.; Dodge City, Kan., 0.04 in.; Chevenne, Wyoming, 0.06 in.; Fort Union, N. M., 0.08 in.; Prescott, Ariz., and Socorro, N. M., 0.11 in.; Pioche, Nev., 0.12 in.; Vail In., 0.14 in.; Stockton, Tex., Mammoth Tank, Cal. and Santa Fé, N. M., 0.15 in.; North Platte, Neb., 0.18 in.; Whitewater, Cal., 0.20 in.; Fort Buford, Dak., and Denver, Col., 0.21 in.; Tulare, Cal., 0.24 in.; Howard, Neb., 0.26 in.; Browns, Cal., 0.27 in.; El Paso, Tex., and Fort Verde, Ariz., 0.30 in.; Clear Creek, Nebr., and Pembina, D. T., 0.32 in.; Umatilla, Or., and Fort Fetterman, Wyoming, 0.35 in.; Fort Custer, Dak., 0.36 in.; Winnemucca, Nev., 0.37 in.; Fort Collins, Col., 0.38 in.

Rainy Days.—The days on which rain or snow has fallen, varies as follows: New England, 15 to 24; Middle Atlantic States, 14 to 20; South Atlantic States, 8 to 20; Eastern Gulf States, 4 to 16; Western Gulf States, 12 to 14; Lower Lake region, 13 to 22; Upper Lake region, 8 to 18; Ohio valley and Tennessee, 14 to 21; Upper Mississippi valley, 8 to 17; Missouri valley, 3 to 11; Red River of the North valley, 5 to 6; Eastern Rocky Mountain Slope, 1 to 11; Texas, 2 to 16; Rocky Mountains, 2 to 10; Middle and Southern Plateaux, 3 to 15; California, 5 to 9; Oregon, 17 to 19.

Cloudy Days.—The number varies in New England from 9 to 17; Middle Atlantic States, 9 to 17; South Atlantic States, 3 to 19; Eastern Gulf States, 0 to 15; Western Gulf States, 13 to 17; Lower Lake region, 11 to 15; Upper Lake region, 6 to 15; Ohio valley and Tennessee, 12 to 17; Upper Mississippi valley, 6 to 11; Missouri valley, 2 to 11; Red River of the North valley, 9 to 12; Eastern Rocky Mountain Slope, 3 to 13; Texas, 11 to 20; Rocky Mountains, 1 to 9; Middle Plateau, 0 to 12; California, 2 to 6.

Hail.—California: Mt. St. Helena, 24th, 28th; Princeton, 24th. San Diego, 25th, size of pea; Sacramento, 3rd; Red Bluff, 3rd, 27th; Salinas, 3rd; Visalia and Point San José, 3rd, 25th; Camp Sheridan, Neb., 5th. Illinois: Rockford, 4th; Mt. Sterling, 4th, 5th. Indiana: Vevay, 5th, 25th; Logansport, 23rd; Spiceland, 4th. Iowa: Nora Springs, 3rd, 23rd; Ft. Madison and Independence, 25th; Monticello, 25th, 26th; Cresco and Fort Dodge, 31st. Kansas: Leavenworth, 26th; Yates Center, 7th; Holton, Lawrence, Independence, Cedar Vale and Wellington, 26th; at latter place very large, some stones 1½ to 2 inches in diameter. Massachusetts: Fall River, 16th. Missouri: Oregon, 24th; Corning, 26th. Nebraska: De Soto, 25th. New Jersey: Princeton, 28th. New York: Ft. Niagara, 5th; Starkey, 11th; North Carolina: Weldon, 12th; False Cape, 30th. Ohio: North Lewisburg, 4th; Norwalk, 5th, Jacksonburg, 10th, 15th, 26th; Cincinnati, 11th; Bellefontaine, 4th, 27th; Wooster and Ringgold, 27th; at latter place covering ground, of all shapes and sizes. Pennsylvania; Dyberry, 25th. Vermont: Woodstock and Lunenburg, 5th. Virginia: Walnut Grove, 28th, 30th, 31st; Cape Henry and Norfolk, 28th. Idaho: Boise City, 11th. Oregon: Portland, 11th, 25th: Umatilla and Roseburg, 25th; Washington Territory: Dayton, 3rd. Dakota: Ft. Yates, 26th, 27th. Texas: Denison, 31st; Galveston, 21st. Vermont: Burlington, 5th. Wisconsin: La Crosse, 25th, 26th. Kentucky: Louisville, 5th. Georgia: Atlanta, 27th.

Snow—fell frequently in the northern half of the country to the end of the month. At points of special interest it fell as follows: On summit of Mt. Diablo, Cal., 4th, 5th; Ft. Union, N. M., 1st to 21st; Portland, Or., 1st to 16th; La Cruces, N. M., 15th, 18th; McKavett and Uvalde, Tex., 14th; False Cape, N. C., 30th; Augusta, Ga., 12th, light spits; Lynchburg, Va., 12th; Melissa and Mesquite, Tex., 15th.

Largest Monthly Snow-fall in Inches.—California: Summit, 89; Cisco, 76; Truckee, 46.5; San Gorgonio. 13.5; Mt. Washington, N. H., 48.7; South Lee, Mass., 35; Pike's Peak, 27.9; Oswego, 25.9; Alta, Cal. and Newport, Vt., 19; Duluth, Mich. and Springfield, Mass., 18.3; Westborough, Mass., 17.5; Flushing, N. Y., and Dunbarton, N. H., 16; Somerset and Rowe, Mass., Freehold, N. J., 55; Southington and Grafton, N. H., 15; Fall River, Mass. and Escanaba, Mich., 14; Antrim, N. H., and Neillsville, Wis., 13.

Snow on Ground at end of Month.—On summit of Mt. Washington, 24 to 36 inches; on summit of Pike's Peak, 4 inches; Westborough, Mass., 3 inches; Auburn N. H., 1 inch;

Rain and Snow from a Cloudless Sky.—Las Cruces, N. M., 18th, snow; Oswego, N. Y., 15th, snow; Woodstock, Vt., 6th, rain.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 62 to 84; Middle Atlantic States, 60 to 73; South Atlantic States, 63 to 78; Eastern Gulf States, 68 to 75; Western Gulf States, 67 to 84; Ohio valley and Tennessee, 57 to 74; Lower Lake region, 66 to 72; Upper Lake region, 61 to 76; Upper Mississippi valley, 59 to 70; Missouri valley, 60 to 82; Red River of the North valley, 90 and 91; Eastern Rocky Mountain Slope, 46 to 64; Texas, 44 to 75; Western Plateau, 36 to 62; California, 46 to 74; Oregon, 72 to 80. *High stations* report the following averages not corrected for altitude: Mt. Washington, 87.8 per cent.; Cheyenne, 42.0; Denver, 40.4; Virginia City, 58.0; Santa Fé, 41.6; Pike's Peak, 65.5.

WINDS.

The *prevailing direction of the winds* for the month of *March*, 1880, is shown by arrows flying with the wind, on chart No. II. The prevailing winds throughout the country east of the Rocky Mountains except in Texas and along the South Atlantic and Florida coasts were *northwesterly*. Along the Atlantic coast from Boston southward to Norfolk the prevailing direction at every station was *northwest*.

Total Movements of the Air.—The following are the *largest* total movements recorded in miles at the Signal Service stations during the month of *March*, 1880: Pike's Peak, 19,785; Delaware Breakwater, 15, 269; Sandy Hook, 14,140; Cape Lookout, 13,715; Kittyhawk, 13,426; Thatcher's Island, 13,095; Indianola, 12,419; Barnegat, 12,344; Cape Henry, 12,187; Cape Hatteras, 11,996; Wood's Holl, 11,913; Portsmouth, N. C., 11,982. There is no report from Mt. Washington, owing to frost interfering with the registering apparatus, but velocities exceeding 50 miles were reported on 21 days. The following are the highest, 3rd, 6th, 12th, 17th and 24th, NW. 84 miles; 25th, N., 90; 22nd, NW., 93; 5th, 14th, 26th, NW., 96; 7th, W., 102. The *smallest* movements are Nashville, 2,314; Deadwood, 2,337; Roseburg, Or., 2,883; Tucson, Ariz., 2,873; Uvalde, Tex., 2,939; Visalia, Cal., 3,034; La Mesilla, N. M., 3,218; Lynchburg, Va., 3,286; Ft. Buford, Dak., 3,300; Los Angeles, Cal., 3,622.

Local Storms.—Indianapolis, Ind., 4th., about 10.30 p. m. a severe tornado visited the city, passing through the northern section, in a direction from southwest to northeast. The storm-cloud appeared as an immense dark mass with a long trunk extending downward toward the earth, and accompanied by a loud rumbling noise like an approaching train of cars. The cloud, during its progressive movement, pursued a zigzag course, alternately changing from NE. to SE., which was indicated by the debris. The destruction to property was estimated at $100,000. Alto, Ind., 4th, about 10 p. m. severe wind and rain storm, one house destroyed and its nine occupants injured—one fatally. La Fayette, Ind, 4th, about 10 p. m. heavy wind and rain storm, causing considerable damage. Spencer, Ind., 4th. about 10 p. M. heavy wind and rain storm, fences and out-buildings destroyed. Liberty, Ind., 5th, a very severe wind and rain storm from the west in the early morning, causing considerable damage. Toledo, 4th, 11.15 p. m., a severe tornado passed over the city from southwest to northeast, causing immense damage to property, killing two persons and injuring several others. At several points in the storm's path the rotary movement from right to left of the destructive winds—a characteristic feature of the tornado—was developed, as shown by the direction of the debris. Persons who were out during the storm reported vivid lightning and heavy thunder in the south and southwest. Shortly before the storm broke upon the city the barometer fell rapidly and the atmosphere was decidedly close and oppressive. Madison, Ind., 5th, at 2, a. m. a heavy wind and rain-storm, causing great loss to property. Clayton, Bourbon co., Ala. 15th, a very severe storm of wind and rain during the night delayed all railroad communication in the vicinity, and trees and fences were generally destroyed. One house was completely demolished, and others more or less damaged. Pike co., Ala., 18th., a destructive tornado was reported to have passed across the southern portion of the county during the evening, causing great damage to timber and fencing, and blowing down and unroofing houses. The tornado struck about three miles west of Smilie's bridge on Corench river, and took an easterly course for a distance of ten miles, when it disappeared. The buildings and fences on fourteen plantations were scattered in ruins.

The following notes are of interest respecting the unusually heavy wind-storms of the 26th and 27th: Las Cruces, N. M., 26th, very violent sand storm, filling the air with dust. Omaha, Neb., 26th, very sudden and violent west wind, overturning buildings; 27th, heavy wind still continued, three houses blown down—many unroofed; dummy trains could not cross railroad bridge during the day. Leavenworth, Kan., 27th, blinding dust-storm almost obscuring the sun at 10 a. m. Ft. Gibson, Ind. Ter., 27th, violent wind-storm, blowing down flag-staff at Post and injuring buildings slightly; Ft. Davis, Tex., violent sand-storm; Corsicana, Tex., 26th, severe wind-storm, doing considerable injury; St. Louis, 27th, wind SW. 60 miles at 8 a. m., and several times during the day reached a velocity of 48 miles; Keokuk, Iowa, 27th, violent wind-storms, SW. 37 miles; Davenport and Dubuque, Iowa, and Springfield, Ill., 27th, violent thunder-storms with heavy wind, remarkable fall in the barometer; Milwaukee, Wis., 27th, wind 40 miles E. and barometer lowest on record, much damage to city property and shipping; Knoxville, Tenn., 27th, violent SW. wind, blowing down saw-mill killing one man; Morristown, Dak., 27th, high wind-storm unroofing buildings; Louisville, Ill., 27th, most violent wind-storm in many years; New Corydon, Ind., 27th, very violent gale, estimated velocity 60 miles; Muscatine, Iowa, 27th, worst storm of wind and rain that has ever visited this section, barometer remarkably low; Lawrence, Kan, 27th, violent wind storm maximum velocity 70 miles from 3 to 5 a. m.; Wellington, Kan., 27th, severe NW. gale, much damage to buildings; Cedar Vale, Kan., 26th and 27th, violent gale, much damage to fences, trees and buildings; Ashley, Mo., 27th, high wind, blowing down trees and fences; Pierce City, Mo., 27th, 2 a. m., high wind from the NW., blowing down much fencing; Genoa, Neb., 26th, violent wind storm from the west; Howard, Neb., 27th, most violent wind storm for many years, dust gathered in drifts from 1 to 2½ feet in depth; Ringgold, Ohio, 27th, heavy wind and hail storm. Professor Nipher reports this storm as the "most remarkable phenomenon of the month. It covered the entire State, except the extreme southern part. The atmosphere was filled, during the whole day, with a fine grayish dust, which, in the western part of the State and in eastern Kansas, was so dense as to obscure the light of the sun and to render objects invisible at a distance of from 100 to 300 yards. The wind was very high, coming, in most cases, from the west and northwest."

Sand Storms.—Ft. Garland, Col., 12th, (13th violent). Umatilla, Or., 5th, most violent; maximum velocity, 62 miles W. at 12 and 12.30 p. m., accompanied with electricity so intense that it was impossible to touch anemometer wire or battery without experiencing severe shock; 25th, very violent and accompanied with much electricity. Las Cruces, N. M., 26th; Davis, Tex., 27th; Ft. Yuma, 7th, 25th.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for March, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 85.4 per cent. The percentages for the four elements are: Weather, 87.1; Direction of the Wind, 82.1; Temperature, 86.0; Barometer, 86.1 per cent. By geographical districts they are: for New England, 85.5; Middle States, 86.6; South Atlantic States, 87.0; Eastern Gulf States, 84.4; Western Gulf States, 79.4; Lower Lake region, 87.3; Upper Lake region, 87.1; Tennessee and the Ohio valley, 83.7; Upper Mississippi valley, 85.6; Lower Missouri valley, 87.2; Northern Pacific region, 77.5; Central Pacific coast region, 87.5; Southern Pacific coast region, 88.3. There were 14 omissions to predict out of 3,813, or 0.37 per cent. Of the 3,799 predictions that have been made, 137, or 3.60 per cent, are considered to have entirely failed; 109, or 2.87 per cent, were one-fourth verified; 443, or 11.66 per cent, were one-half verified; 463, or 12.19 per cent, were three-fourths verified; 2,647, or 69.68 per cent, were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary Signals.—260 Cautionary Signals were displayed during the month, of which 225, or 86.5 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 94 Off-shore Signals were displayed, of which 85, or 90.4 per cent, were fully justified; 90, or 95.7 per cent, were justified as to direction; 86, or 91.5 per cent as to velocity; and 3, or 3.2 per cent, were not justified either as to direction or velocity. 52 of the Off-shore were changed from Cautionary. 354 Signals of both kinds were displayed, of which 310, or 87.6 per cent, were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 67 cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river gauges for the month, with the dates of the same. The *Red River* at Shreveport rose gradually during the month from about 10 feet on the 1st to nearly 23 feet on the 31st. The *Arkansas* at Little Rock rose 4 feet from the 2nd to the 11th, remained almost stationary until the 17th, then fell to end of month. The *Missouri* varied but little throughout the month, the total range at the three stations, Yankton, Omaha and Leavenworth, being from 3 to 4 feet; above Yankton it continued frozen until the latter part of the month—see notes on ice given below. The *Mississippi* remained closed at St. Paul until the 29th; from La Crosse to St. Paul the total range did not exceed 4 feet; at Cairo the water fell slowly from 1st to 6th, it then rose slowly, and, passing the danger-line (40 feet) on the 9th, reached 44 feet 7 inches from the 21st to the 25th, after which it slowly fell and passing the danger-line on the 30th reached 38 feet 11 inches on the 31st; at Memphis the water continued almost stationary and within a few inches of danger-line (34 feet) from the 1st to the 18th when it passed the danger-line and continued a few inches above that point to the end of month, the total monthly range being only 17 inches; at Vicksburg the water rose slowly from the 2nd, and passing the danger-line (41 feet) on the 11th, reached 42 feet 11 inches on the 31st; at New Orleans it rose slowly from the 18th, and, passing the danger-line on the 10th, reached the maximum height, 13 inches above the danger-line, on the 28th. Notwithstanding the long continued high stage of water from Cairo to New Orleans the amount of damage reported was comparatively small; the principal crevasses reported were (1) above Arkansas City, flooding town and adjoining plantations, (2) near Gaines' Landing, flooding the Yellow Bayou country, and (3) in Bayou La Fourche, near Lockport, causing little damage. The most damage probably occurred at Cairo, where one-fourth of the city grounds were overflowed 3 to 5 feet by "snipe" water. The *Ohio* at Pittsburg, fell from 9 ft. 5in. on the 1st, to 6 ft. 9 in. on the 4th, rose to 14 ft. on the 6th, fell to 6 ft. 6 in. on the 14th, rose to 10 ft. 9 in. on the 17th, fell to 5 ft. on the 27th, rose to 9 ft. 6 in. on the 29th and fell to 8 ft. 3 in. by end of month; at Cincinnati the water continued almost stationary, (at about 28 ft.) until the 6th, when a rapid rise set in reaching 44 ft. 9 in. on the 10; on the 12th the water commenced falling and reached 21 ft. 11 in. on the 26th, after which it rose slowly to end of month; at Louisville a rise of 8 ft. occurred from the 8th to 12th, and the water remained comparatively high until the 20th, after which it fell to 8 ft. 8 in. on the 28th. The *Tennessee* at Chattanooga generally rose from the begining of the month to the 18th, when the water reached 37 ft. 7 in. or 4 ft. 7 in. above danger-line, after which it fell, passing the danger-line (33 ft.) on the 20th and reaching 7 ft. 2 in. on the 31st; on the 19th the low lands near the city were overflowed. The *Cumberland* at Nashville rose from 34 ft. on the 1st to 40 ft. on the 4th; fell to 32 ft. on the 7th, after which it rose and passing the danger-line, (42 ft.) on the 12th reached 46 ft. 6 in. on the 17th; it remained almost stationary at this high stage until the 20th, after which it fell rapidly, and on the 31st reached 11 ft.; portions of the city were flooded and houses had to be vacated. The *Savannah* at Augusta remained almost stationary until the 9th, when a rapid rise set in; on the 17th the water reached the highest stage, (28 ft. 5 in.,) after which it fell to 9 ft. at end of month. The *Alabama* at Montgomery, from the 15th to the 20th, overflowed

low lands and the *Chattahoochee* at Gainesville, Ga., on the 16th, overflowed, causing much damage to crops, fences and bridges. Since printing the table of heights of rivers on chart No. III the reports received from Portland, Oregon, give the height of water in the Columbia river: highest, 3rd, 5 ft. 6 in.; lowest, 22nd and 23rd, 1 ft. 4 in.

Ice in Rivers and Harbors.—The following notes on the breaking up of ice, &c., and opening of navigation are reported by observers: *Yellowstone River.*—Fort Keogh, Mont., 23rd, ice broke up. Fort Buford, 24th, ditto. *Missouri River.*—At Fort Buford, Dak. T., the river below the mouth of the Yellowstone broke up on the 26th and above on the 28th. Fort Stevenson, ice broke up on the 29th, Bismarck, 30th, Fort Yates, 30th, 1:30 p. m. Omaha, ice disappeared on the 20th. Plattsmouth, river open on the 2nd, closed on the 14th, and open again on the 20th. *Dakota River.*—Morriston, ice disappeared on the 25th. *Mississippi River.*—St. Paul, ice broke up on the 26th, but remained gorged until the 29th. La Crosse, 6th, river open; 14th to 18th, river frozen above city; 12th, first steamboat arrived from below. Davenport, 1st to 18th, floating ice. Keokuk, from 1st to 17th, floating ice. Burlington, 17th, river clear of ice. *Rock River.*—Rockford, Ill., 14th and 15th, frozen over. *Des Moines Rapids Canal.*—8th, open. *Lake Superior.*—Duluth, harbor closed entire month; 31st, the ice was two feet thick and extended out about thirty miles. Marquette, 24th, the ice in the bay over two feet thick. *Lake Huron.*—Alpena, 8th, steamer left port, but had to return, and was ice-bound until the 23rd; river frozen until the 30th. Port Huron, 18th, first boat from Toledo. *Lake Michigan.*—At Escanaba navigation closed; bay frozen throughout month. At Northport the bay continues low; navigation opened on the 31st. Milwaukee, 13th and 14th, ice around pier. *Detroit River.*—Detroit, first steamer left on the 9th; 13th to 19th, river full of floating ice. *Lake Erie.*—Toledo, coasting scows running on the 2nd; first steamers and schooners left on the 13th. Buffalo, 19th, first vessels arrived. Sandusky, 8th, first vessel left port. Cleveland, 9th, first steamer arrived. *Lake Ontario.*—Rochester, 23rd, first vessel arrived; Oswego, 21st, ditto. Catawissa, Pa, 17th, North Branch of Pennsylvania canal opened for navigation. *Otsego Lake.*—Cooperstown, N. Y., lake open on the 5th, but closed again on the 9th. *Hudson River*, Albany, 1st, river open to New York; 10th, first steamer left for New York. *Lake Champlain.*—Burlington, 6th, lake open; 23rd, temporarily frozen over; 29th, Shelbourne Bay, south of city, still closed with heavy ice; 29th, first steamer left for Plattsmouth. *Lake Massabesic.*—Auburn, N. H., 31st, about half free of ice.

High Tides.—Atlantic City, 29th; Portsmouth, N. C., 10th, 29th; Indianola, Tex., 21st, 22nd.

Low Tides.—Baltimore, 25th.

TEMPERATURE OF WATER.

The *temperatures of water* as observed in rivers and harbors, with average depth at which observations were taken, is given in the table on the left side of chart No. II. At the following stations observations were not made on the dates indicated on the account of ice:—Duluth, Escanaba and Marquette throughout the month; Alpena, 1st to 29th; Milwaukee, 13th and 14th; Detroit, 13th to 19th; Burlington, 1st to 7th and 9th to 28th. On account of breakage of thermometer no observations were made at Alpena on 30th and 31st: at Eastport from 10th to 31st; at Milwaukee from 28th to 31st; at New York City, from 1st to 7th and 19th to 25th, and at San Francisco from 1st to 13th.

ATMOSPHERIC ELECTRICITY.

Thunder-storms—were reported in the various districts as follows: New England, 5th; Middle Atlantic States, 4th, 5th, 22nd, 23rd, 26th to 28th; South Atlantic States, 5th, 6th, 13th to 16th, 18th, 27th, 28th; Gulf States, 8th to 16th, 18th, 19th, 27th, 28th, 31st; Tennessee and the Ohio valley, 3rd to 6th, 11th, 12th, 16th, 23rd, 25th to 29th, 31st; Lake region, 3rd to 5th, 27th; Upper Mississippi and Lower Missouri valleys, 2nd to 6th, 25th to 27th, 31st; California, 3rd at Sacramento and Visalia, 14th at San Diego.

Auroras.—Isolated cases of aurora are reported as follows: 1st, Pembina, Dak.; 3rd, Oregon, Mo.; 8th, Nora Springs, Iowa; Manitowoc, Wis., 9th, 10th, dark segment with "merry dancers;" 9th and 21st, Frankfort, Mo.; 16th, Starkey, N. Y.; 10th, Orono, Me.; 15th, Ft. Stevenson, Dak., ranging from 60° N. to 60° W.; the beams had a quick lateral motion and were most brilliant about 3 a. m. of the 16th; the beams displayed the greatest brilliancy and altitude when due north, sometimes reaching the zenith; 16th, aurora similar to the 15th though not so brilliant; Ft. Sisseton, Dak., 21st, 8 to 11 p. m; Williamstown, Mass., 30th. On the 12th at Burlington, Vt., 11:15 p. m., and Eastport, Me., 11:45 p. m.; color, pale yellow, few streamers, no dark segment. Starkey, N. Y., 8 p. m. On the 13th an aurora was observed from Eastport, Me., to Ft Sisseton, Dak., except where cloudy weather prevented observations. The following descriptions are reported: At Eastport, Me., faint, and of pale yellow color; it began at 11:45 p. m. of the 13th, and ended at 3:00 a. m. of the 14th. At Burlington, Vt., seen for a few minutes through a rift in clouds, and was observed to be faint. Pembina, Dak., "very brilliant aurora at 7 p. m. of the 13th, and continued into the night. The whole northern sky was more or less illumined and the light emitted was almost equal to the moon at the full. A broad arch of light, very bright but rather ill-defined, extended 170° to 270° azimuth, and sometimes reached the zenith. There was a good deal of movement, but it was rather slow and the eye had some difficulty in detecting it. There was also some striated lines of light crossing the arch but nothing like "merry dancers." A peculiarity of this aurora was a number of large whorls of nebulous light, like the large nebula in Canes Venatici, which appeared at several points along

the arch and also beneath it. These whorls were constant as to duration, but not as to position, as they constantly changed the latter, but were at no time entirely absent. There was very little variety of color, the only deviation from white being some faint traces of greenish yellow which occasionally appeared in the whorls. Ft. Sisseton, 7 to 11 p. m., very bright. The display of the 17th is interesting from its unusual extent and brilliancy. It was observed from Eastport, Me., to Fort Benton, Dak., except in sections where cloudy weather prevailed. The most southerly station reporting was Somerville, N. J., where it was faint. The following are the other stations reporting it: in *Maine*, Orono, Bangor and Gardiner; *New Hampshire*, Grafton; *Massachusetts*, Newburyport, Boston, Springfield, Williamstown and Fall River; *Connecticut*, New Haven and New London; *New York*, Madison Barracks, North Volney, Palermo, Oswego and Lima; *Pennsylvania*, Catawissa; *Ohio*, Toledo; *Michigan*. Detroit, Lansing and Alpena; *Wisconsin*, Manitowoc; Dakota: Pembina. It is described as follows: Bangor, Me., from 11:05 till 3 a. m., greatest brilliancy at 12.30 a. m.; extent, from 120° to 140° azimuth; greatest altitude, 37°; peculiarity, slender luminous beams, "merry dancers" and dark segment, color brilliant yellow. Eastport, from 9 p. m. to 3 a. m. of the 18th, extending from NW. to NE.; altitude, 40°; peculiarities, an arch with six luminous beams shooting upwards; color, straw. Springfield, Mass., 9.30 to 10.30 p. m.; very brilliant, dark arch, altitude 18°, with "merry dancers" shooting up to altitude of 30°. New Haven, Conn. Appeared at 8 p. m. It consisted of an arch of white light, measuring 12° of altitude and 40° of azimuth, with a dark-colored segment below the arch, the segment below the arch, the segment being so dark as at first to be mistaken for a cloud. Between 8 and 9 p. m. streamers of quivering white light shot upwards nearly to the zenith. The display lasted until daylight of the 18th, and would doubtless have been very brilliant but for the moon, which shone brightly during most of the time. Oswego, N. Y., from 11 p. m. till after midnight; azimuth, 50°; altitude, 5°; a luminous arch resting on dark segment; changes slight. Grafton, N. H., "first appeared at 7:20 p. m., continuing until 4 a. m. 18th. Streamers appeared at 9:30 p. m., reaching their greatest brilliancy at 10 p. m., having an altitude of 70° and a quick motion from east to west, bearing north. From 10 p. m. to 1:30 a. m. of diffuse white color, intermixed with patches of dark segments, reaching at latter hour an altitude of 40°, which was mainly the altitude of the aurora during the rest of the night. At 1:35 a. m. the aurora had a dancing motion, up and down, with the rapidity of lightning. From this time until the end, the aurora was mainly of a diffuse white, with patches of dark segment mixed in. The aurora was observed all around the horizon. The patches of dark segment had a slow lateral motion from W. to E. No dark clouds below the arch observed." Pembina, Dak., the aurora appeared at 7 p.m. It would probably have been brilliant, but for the influence of the moonlight, but as it was, the display was rather pale. It extended from about 175° to 260° azimuth, and at times almost reached the zenith. There were three arches of light of very unequal brilliancy, the upper one being generally brilliant. Occasionally, rays of light started from the lower arch and reached across the upper one, and remained for a time with a tremulous motion. Those rays generally preceded the breaking up of the upper arch into hazy nebulous masses, which soon afterwards di-appeared, while a new arch was developed beneath the others. After 10 p. m. there was only one arch visible, and at 11:30 p. m. it had nearly disappeared. North Volney, N. Y., streamers soon changing to striated mass.

Telegraphic Communication interrupted by Atmospheric Electricity.—Socorro, N. M., 2nd and 26th; Dodge City, Kan., 4th, severe electric storm, telegraphic instruments could be worked without battery at times, the air was filled with floating sand; Decatur, Tex., 26th,; Castroville, Tex., 11th and 21st; Mason, Tex., 2nd, 7th and 26th.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service Stations. Reports from 135 stations show 4,108 observations to have been made, of which 23 were reported doubtful; of the remainder, 3,347 or 81.9 per cent. were followed by the expected weather.

Zodiacal Light.—Southington, Conn., 5th, 8th, 10th, 30th. *Indiana*, New Corydon, 1st, 2nd, 5th, 28th, 29th, 30th; Wabash, 1st, 5th, 8th, 29th. *Iowa*, Cresco, 5th, 9th, 11th; Monticello. 1st, 3rd, 5th, 8th, 9th, 11th, 28th; Ft. Dodge, 1st, 5th, 28th, 29th. *Kansas*, Cedar Vale, 1st, 3rd, 4th, 7th, 10th, 27th, 30th; Yates Center, 1st, 7th, 28th, 30th, 31st. *Massachusetts*, Harvard College, Cambridge, 2nd, (4th at 8:30 p. m., Gamma Arietis and Zeta seemed to be on opposite borders of the light); 5th, 8th, 10th, distinct, perceptible on the 12th, other nights moonlight or cloudy; Rowe, 2nd, 6th; Somerset, 1st, 2nd, 4th, 5th, 6th, 8th, 10th, 30th, 31st. *Missouri*, Oregon, 1st to 4th, 7th to 10th, 28th to 31st. Clear Creek, Nebr., 1st, 8th, 28th. Freehold, N. J., 1st; Atco, N. J., 1st, 2nd, 5th, 10th, 31st; Waterburg, N. Y., 2nd, 4th, (6th, bright), 8th, 11th, (30th, bright), 31st; Ithaca, N. Y., 31st; Bellefontaine, Ohio, 1st, 2nd, 30th, 31st; Dyberry, Pa., 10th; Coalville, Utah, 4th; Wytheville, Va., 2nd, 4th, 5th, 9th, 29th, 31st; Dubuque, 11th; New Haven, Conn., 2nd, 6th, 8th, 30th; Lynchburg, Va., 26th, 29th, 30th, 31st; Mr. Chas. Hasselbrink, observer at Havana, Cuba reports as follows, from March 27th; 27th visible from 7:15 to 7:50 p. m., "light rises almost vertically and vanishes in the region about Omega Taurus; at beginning of observations noted a luminous band which extended horizontally as far as Cassiopeia"; 31st visible from 7:15 p. m., not very bright or extensive. Pleiades 30° above the horizon formed the vertex of the triangle of the light. Intermittence in brightness less sensible than in former observations.

Meteors.—Corning, Mo., 3rd, large as full moon and passed through zenith southwards to the horizon; Oregon, Mo., 3rd, very brilliant; Ft. Dodge, Ia., 5th, 7:30 p. m., two small and very swift Perseides, moving from Algal to a point a few degrees below Capella, leaving behind two faint parallel tracks close together; 11th, a large and very slow meteor, dull yellow, size double of Jupiter when first seen but rapidly diminishing, moved along nearly parallel to the horizon and disappeared in four seconds.

Earthquakes.—Los Angeles, Cal., 6.25 a. m., most violent for many years, lasting about five seconds and felt within a radius of several miles; vibration from northeast to southwest, with a verticle impulse. San Gorgonia, Cal., 25th, 2.30 a. m., moderate, but sufficient to cause a perceptible vibration of the houses; duration about three seconds and direction from southeast to northwest.

Sun Spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanic Office, Washington, D. C.:

Date—March, 1889.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
1st, 3 p. m...	0	1	0	0	0	0	2	3	
2nd, 8 a. m...	0	2	0	0	0	0	2	5	Faculæ.
4th, 8 a. m...	0	0	1	4	0	0	1	1.	Several groups of faculæ.
5th, 1 p. m...	1	1	1	1	0	0	1	1	Faculæ.
6th, 1 p. m...	0	1	0	0	0	0	1	2	
10th, 2 p. m...	2	4	1	2	0	0	2	4	Faculæ. Spots probably disappeared by solar rotation.
17th, 8 a. m...	2	2	.....	.....	.....	.....	2	2	
18th, 8 a. m	0	0	0	0	0	0	2	2	
19th, 6 p. m...	0	0	1	1	0	0	1	1	
20th, 8 a. m...	0	0	0	0	0	0	1	1	
26th, 7 a. m...	1	2	0	0	0	0	1	2	
30th, 7 a. m...	1	6	0	0	.....	.....	2	8	Broad areas of faculæ.
31st, 9 a. m...	0	0	0	0	0	0	2	8	Faculæ.
3 p. m	1	2	0	0	0	0	3	10	Faculæ.

21st, 8 a. m., 22nd, 9 a. m., 4 p. m., faculæ but no spots; 23rd, 9 a. m., 24th, 8 a. m., 5 p. m. and 25th, 8 a. m., no spots or faculæ.

Mr. William Dawson, at Spiceland, Ind., reports: 1st, one large spot in SW. quadrant, 3 smaller spots near W. limb; 2nd, group of small spots increased to 7; 9th, 5 spots in one group in NW. quadrant; 15th, 5 spots in one group near W. limb, one prominent spot near E. limb; 17th, 1 spot and faculæ near W. limb, one large spot near east of centre; 23rd, no spots; 29th, one large spot near E. limb, group of 10 small spots in SW. quadrant; 30th, 1 large spot near E. limb, and a group of 3 small spots 4′ W. of it, also a group of 10 small spots near W. edge; 31st, small spot just above the large one, 3 spots in group to W. of it and only 5 spots in the western group.

The Signal Service observer at New Haven, Conn., reports, 4th, 1:30 p. m., small spot very near NW. limb; 8th, 1 p. m., group of 4 small spots NE. of centre; 31st, 12:30 p. m., 1 large spot near centre, and group of 3 in NE. centre.

Mr. F. Hess, at Ft. Dodge, Ia., reports, 1st and 2nd, 9 a. m., 1 spot in SW. quadrant and group of 3 in NW.; 5th, noon, 2 groups of brilliant faculæ near NE. limb; 6th, noon, 4 spots in SW.; 7th, noon, ditto with faculae and a new group of 2 spots in NW.; 8th, 8 a. m., 1 spot in SW. and 3 in NW.; 9th, noon, 3 small spots in NW.; 10th, 4 p. m., 1 large spot in NW.; 11th, 11 a. m., one large and one small spot in NW. 14th, 10 a. m., 2 new groups, one very large double spot, with 3 or 4 smaller ones and faculæ in NW., and one large spot in faculæ in SE.; 15th, 9 a. m., ditto, and also a new brilliant white spot near SE. limb; 16th and 17th, the 2 groups still visible; 19th and 20th, 9 a. m., one spot in SW.; 22nd to 28th, sun observed each day, but no spots or faculæ seen; 29th, noon, 2 groups, 1 of 5 spots in SW., and one large spot and faculæ near NE. limb; 31st, 1 large spot and faculæ, and 2 small spots surrounded by brilliant faculæ in NW. No observations on the 3rd, 4th, 12th, 18th and 30th.

Published by order of the Secretary of War.

Albert J. Myer

Brig. Gen. (Bvt. Assg^d.) Chief Signal Officer, U. S. A.

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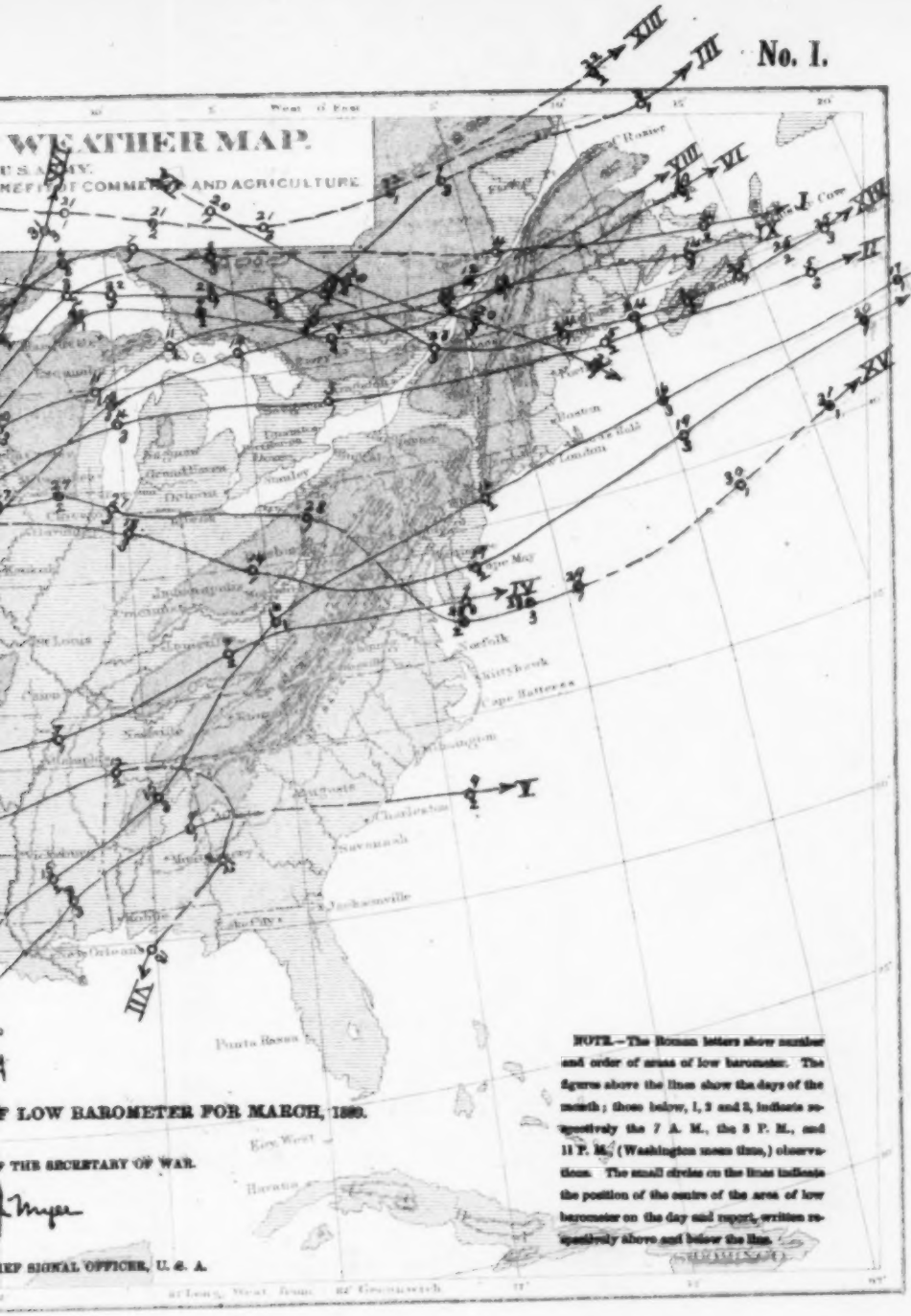
WAR DEPARTMENT W
SIGNAL SERVICE, U.S.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEF
AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.
No. | Velocity.
I. 40 miles per hour.
II. 45 do.
III. 30 do.
IV. 35 do.
V. 30 do.
VI. 40 do.
VII. 35 do.
VIII. 35 do.
IX. 45 do.
X. 35 do.
XI. 40 do.
XII. 40 do.
XIII. — do.
XIV. 25 do.
XV. 30 do.
XVI. — do.
TRACKS OF CENTRES OF AREAS OF LOW
PUBLISHED BY ORDER OF THE
BRIG. GEN., (BVT. ASSO'D,) CHIEF SIG

No. I.



NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M. (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

F LOW BAROMETER FOR MARCH, 1880.

THE SECRETARY OF WAR.

EP SIGNAL OFFICER, U. S. A.

WAR DEPARTMENT WE
SIGNAL SERVICE, U S ARMY
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF C
ISOBARS, ISOTHERMS AND PREVAILING WI
TEMPERATURE OF WATER, ETC
MARCH, 1875.
STATIONS.
Temperature at Sunset.
Max.
Min.
Average depth of water, in feet.
* Albany
Augusta 64° 42° 14.5
Baltimore 67 40.5 14
Buffalo 43 27 10
* Burlington, Vt 34 13 18.5
Cedar Keys 75 64 3
Charleston — — —
Chicago 40 33.5 6
Cleveland — — —
* Detroit 37 32 84
* Duluth — — —
Del. Breakwater 47 46 17
* Eastport 34.5 33.5 15
* Escanaba — — —
Galveston 71.5 50.5 14.5
Grand Haven — — —
Jacksonville 76 66 18
Key West 68 73 14
* Marquette — — —
* Milwaukee 30 24 6
Mobile 69 53 13
New London 41.5 37 13
* New York 41 34 22.2
Norfolk 59 40 22
Portland, Maine 33.5 32 26
Punta Rassa — — —
Sandusky 39 31 10
* San Francisco 50 49 19.5
Savannah 67 56.5 9.2
Smithville 64 55 8
Toledo 45 34 14
Wilmington 65 57 11.5
Wood's Hole 47 37 16
* Observations for only part of month—See text.
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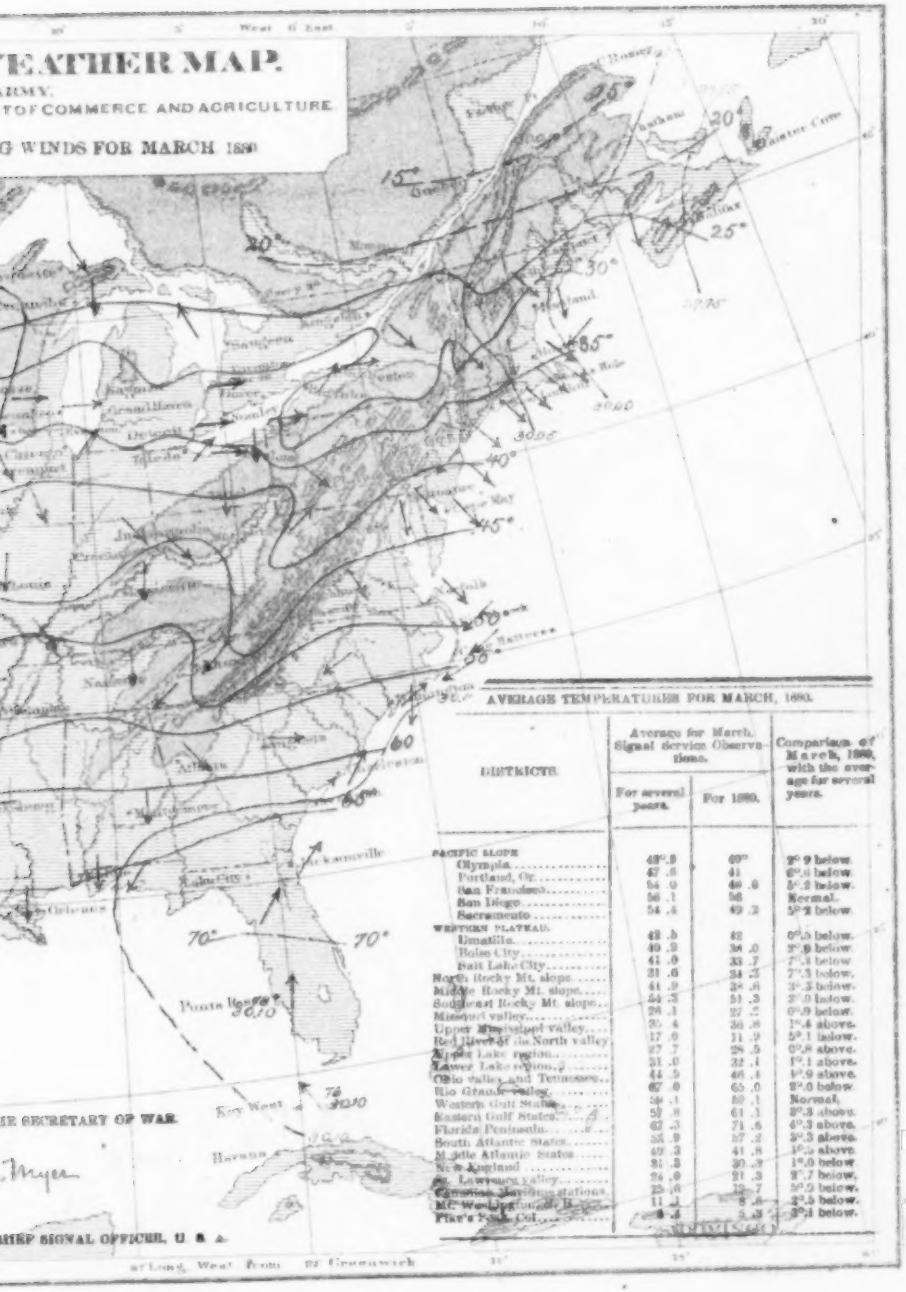
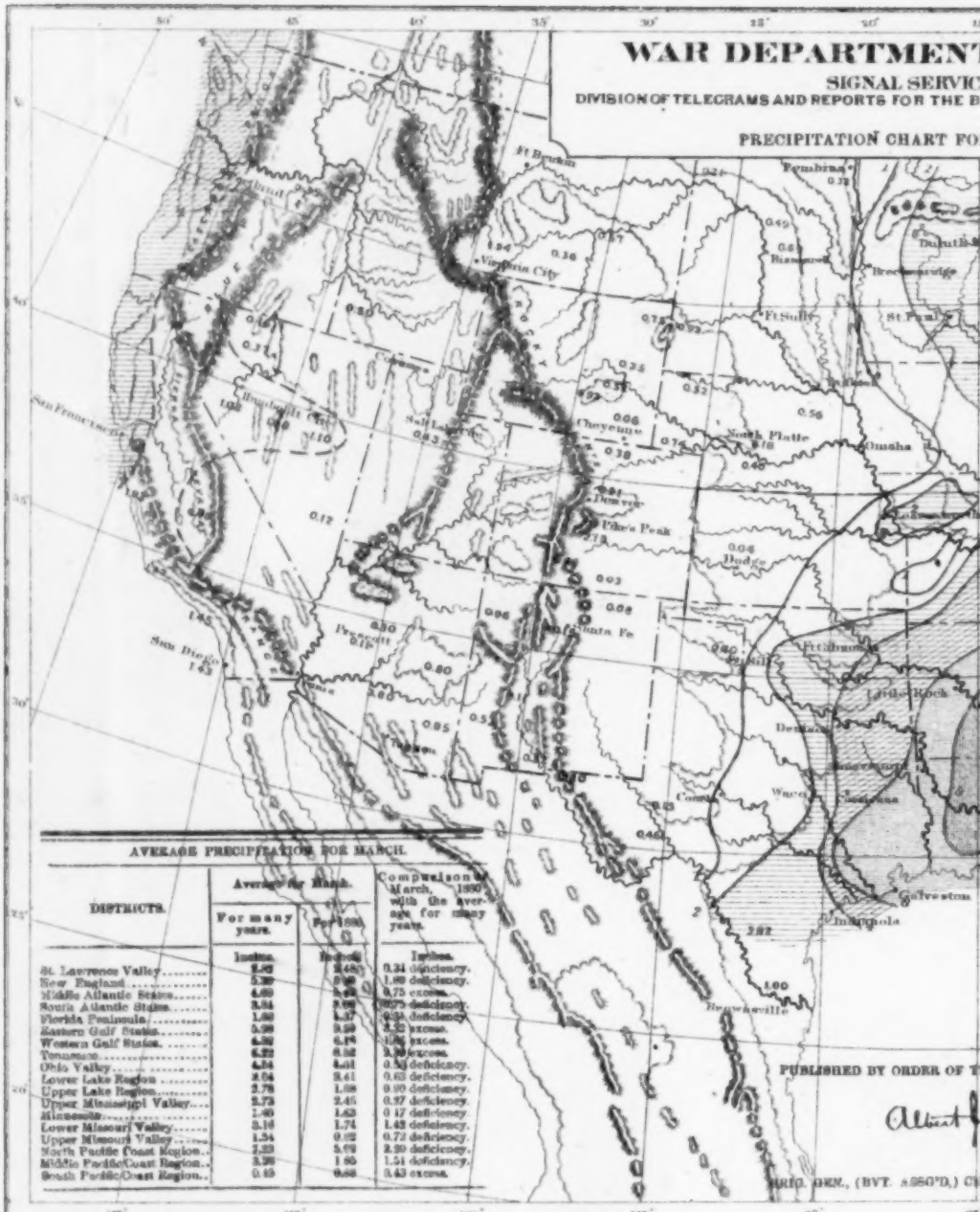
BRIG. GEN., (BVT. ASSO'D,) CHIEF

No. H.



AVERAGE TEMPERATURES FOR MARCH, 1880.

DISTRICTS.	Average for March. Signal service Observations.		Comparison of March, 1880, with the average for several years.
	For several years.	For 1880.	
PACIFIC SLOPE	49°.9	49°	2°.9 below.
Olympia	47 .6	41	6°.6 below.
Portland, Or.	54 .0	48 .6	5°.2 below.
San Francisco	56 .1	56	Normal.
San Diego	54 .4	49 .2	5°.2 below.
WESTERN PLATEAU	43 .5	42	0°.5 below.
Umatilla	40 .9	38 .0	2°.9 below.
Boise City	41 .0	33 .7	7°.3 below.
Salt Lake City	31 .6	34 .3	2°.3 below.
North Rocky Mt. slope	41 .9	38 .6	3°.3 below.
Middle Rocky Mt. slope	54 .3	51 .3	3°.0 below.
Southwest Rocky Mt. slope	28 .1	27 .2	0°.9 below.
Missouri valley	35 .4	36 .8	1°.4 above.
Upper Mississippi valley	17 .0	11 .9	5°.1 below.
Red River of the North valley	27 .7	28 .5	0°.8 above.
Upper Lake region	31 .0	32 .1	1°.1 above.
Lower Lake region	44 .5	46 .4	1°.9 above.
Ohio valley and Tennessee	67 .0	65 .0	2°.0 below.
Rio Grande valley	59 .1	59 .1	Normal.
Western Gulf States	57 .8	61 .1	3°.3 above.
Eastern Gulf States	67 .3	71 .6	4°.3 above.
Florida Peninsula	55 .9	57 .2	1°.3 above.
South Atlantic States	49 .3	51 .8	2°.5 above.
Middle Atlantic States	31 .3	30 .3	1°.0 below.
New England	24 .0	21 .3	2°.7 below.
St. Lawrence valley	25 .6	19 .7	5°.9 below.
Canadian Maritime stations	11 .1	8 .6	2°.5 below.
Mc. Washington, N. H.	6 .4	3 .3	3°.1 below.
Pike's Peak, Col.			



AVERAGE PRECIPITATION FOR MARCH.

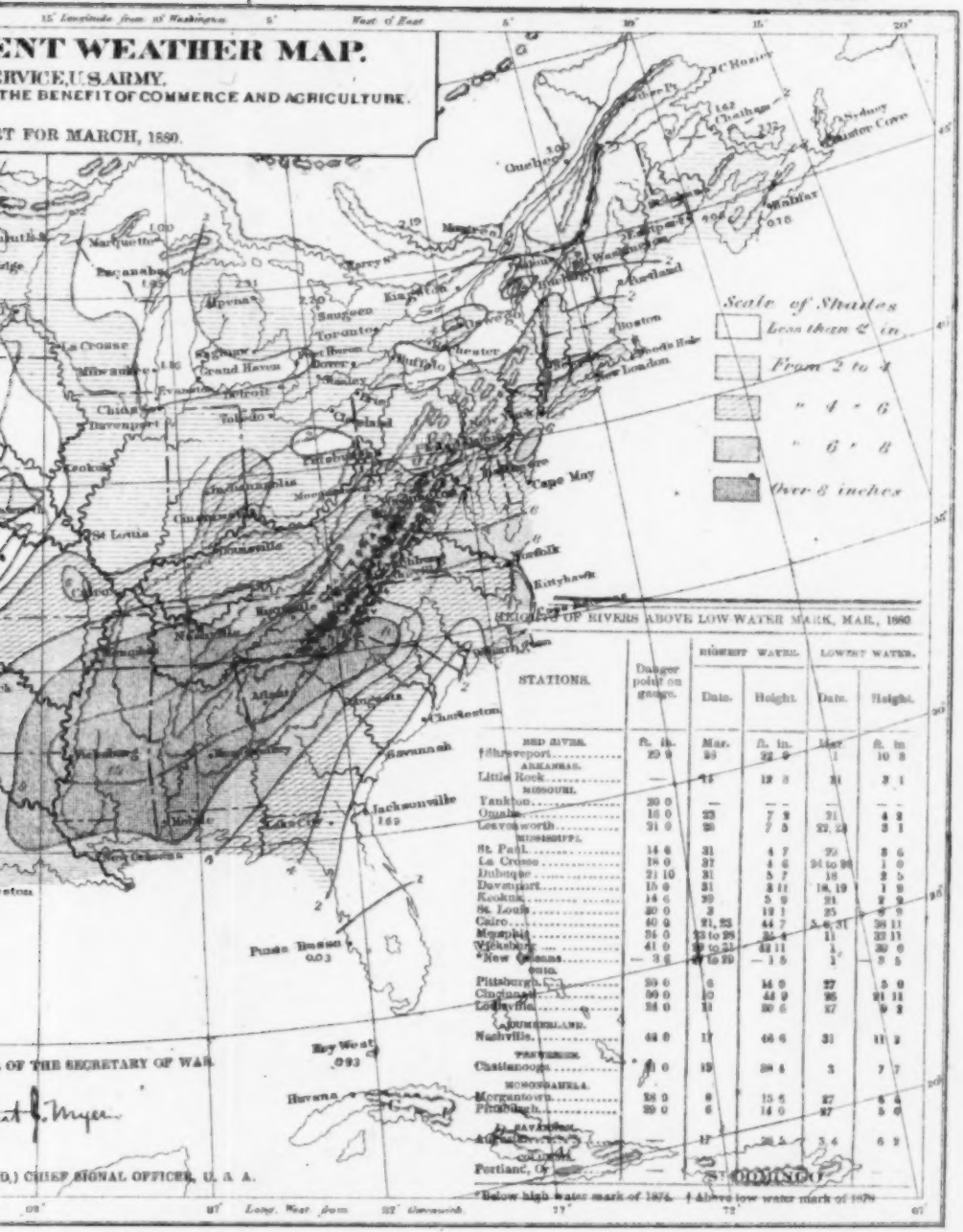
DISTRICTS.	Average for March. For many years.	Average for March. For 1880.	Comparison of March, 1880, with the average for many years.
	Inches.	Inches.	Inches.
St. Lawrence Valley	2.42	2.08	0.34 deficiency.
New England	3.37	1.88	1.49 deficiency.
Middle Atlantic States	4.60	3.85	0.75 excess.
South Atlantic States	3.34	2.98	0.36 deficiency.
Florida Peninsula	1.80	1.37	0.43 deficiency.
Eastern Gulf States	5.99	9.31	3.32 excess.
Western Gulf States	4.32	6.18	1.86 excess.
Tennessee	4.22	6.52	2.30 excess.
Ohio Valley	4.24	4.01	0.23 deficiency.
Lower Lake Region	2.04	3.41	0.63 deficiency.
Upper Lake Region	2.78	1.88	0.90 deficiency.
Upper Mississippi Valley	2.73	2.46	0.27 deficiency.
Minnesota	1.89	1.42	0.47 deficiency.
Lower Missouri Valley	3.16	1.74	1.42 deficiency.
Upper Missouri Valley	1.34	0.62	0.72 deficiency.
North Pacific Coast Region	2.23	5.62	2.39 deficiency.
Middle Pacific Coast Region	3.36	1.85	1.51 deficiency.
South Pacific Coast Region	0.49	0.92	0.43 excess.

ENT WEATHER MAP.

ERVICE, U.S. ARMY.

THE BENEFIT OF COMMERCE AND AGRICULTURE.

ET FOR MARCH, 1880.



HEIGHTS OF RIVERS ABOVE LOW WATER MARK, MAR., 1880

STATIONS.	Danger point on gauge.	HIGHEST WATER. Date.	HIGHEST WATER. Height.	LOWEST WATER. Date.	LOWEST WATER. Height.
RED RIVER.	ft. in.	Mar.	ft. in.	Mar	ft. in.
†Shreveport	29 0	30	32 9	1	10 8
ARKANSAS.					
Little Rock	—	15	12 3	31	2 1
MISSOURI.					
Yankton	20 0	—	— —	—	— —
Omaha	16 0	23	7 2	31	4 2
Leavenworth	21 0	20	7 5	23, 24	3 1
MISSISSIPPI.					
St. Paul	14 6	31	4 7	29	3 6
La Crosse	18 0	27	4 6	24 to 26	1 0
Dubuque	21 10	31	5 7	18	2 5
Davenport	15 0	31	3 11	18, 19	1 9
Rocktow	14 6	29	5 9	31	2 2
St. Louis	30 0	3	19 1	25	6 6
Cairo	40 0	21, 23	44 7	5, 6, 31	36 11
Memphis	34 0	23 to 28	35 4	11	33 11
Vicksburg	41 0	29 to 31	42 11	1	39 6
*New Orleans	— 3 6	27 to 29	— 1 5	1	3 5
OHIO.					
Pittsburgh	30 0	6	14 0	27	5 0
Cincinnati	50 0	10	44 9	26	21 11
Louisville	24 0	11	30 6	27	9 3
CUMBERLAND.					
Nashville	44 0	17	46 6	31	11 9
TENNESSEE.					
Chattanooga	40 0	19	38 4	3	7 7
MONONGAHELA.					
Morgantown	18 0	8	15 6	27	5 6
Pittsburgh	30 0	6	14 0	27	5 0
[illegible]					
[illegible]	—	17	26 5	3 4	6 9
[illegible]					
Portland, Or	—				

*Below high water mark of 1874. †Above low water mark of 1879

(D.) CHIEF SIGNAL OFFICER, U. S. A.

OF THE SECRETARY OF WAR.

STODDING

WINDS ACCOMPANYING THE ATLANTIC STORMS.

No.	Date.	American Coast. Direction.	Miles per Hour.	Meters per Second.	European Coast. Date.	Direction.	Miles per Hour.	Meters per Second.
I.	Feb. 3	SE. & SE.	60 to 70	26.8 to 31.2	Feb. 6	S. & SSW.	*60 to 80	*26.8 to 35.8
II	9	SW. to NW.	35 to 45	15.4 to 20.1	12	S. & SSW.	*40 to 70	*17.9 to 31.3

* Estimated from a scale of 0 to 9.

INDEX TO STORM-TRACKS

Atlantic Ocean.

No. I. from February 2nd, to 8th, 1880.
II. from February 7th, to 12th, 1880.
III. from February 9th, to 11th, 1880.
IV. from February 15th, to 22nd, 1880.
V. from February 13th, to 17th, 1880.

Pacific Ocean.

VII. on December 22nd, and 23rd, 1880.
VIII. on December 26th, and 27th 1880.

INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews*.

The tracks charted in red have been made from data collected since preceding *Review*.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

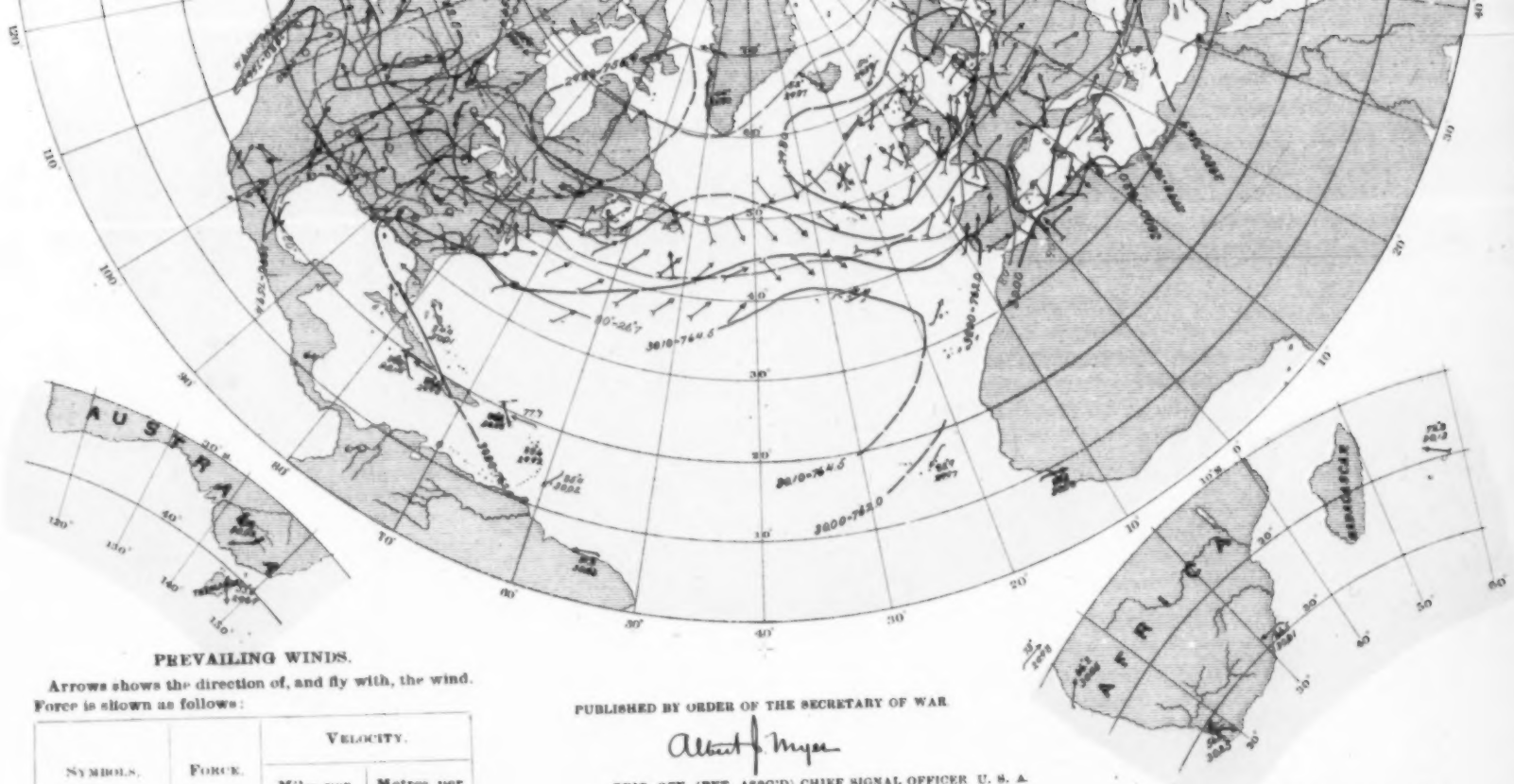
BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

No. V.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing October, 1877.



PREVAILING WINDS.

Arrows shows the direction of, and fly with, the wind.
Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
→	1, 2	0 to 9	0 to 4.0
→	3, 4	9.1 to 22.5	4.1 to 10.1
→	5, 6	22.6 to 40.5	10.1 to 18.1
→	7, 8	40.6 to 67.5	18.1 to 30.2
→	9, 10	67.6 up.	30.2 & over.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER U. S. A.

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.

INTERNATIONAL MONTHLY CHART.

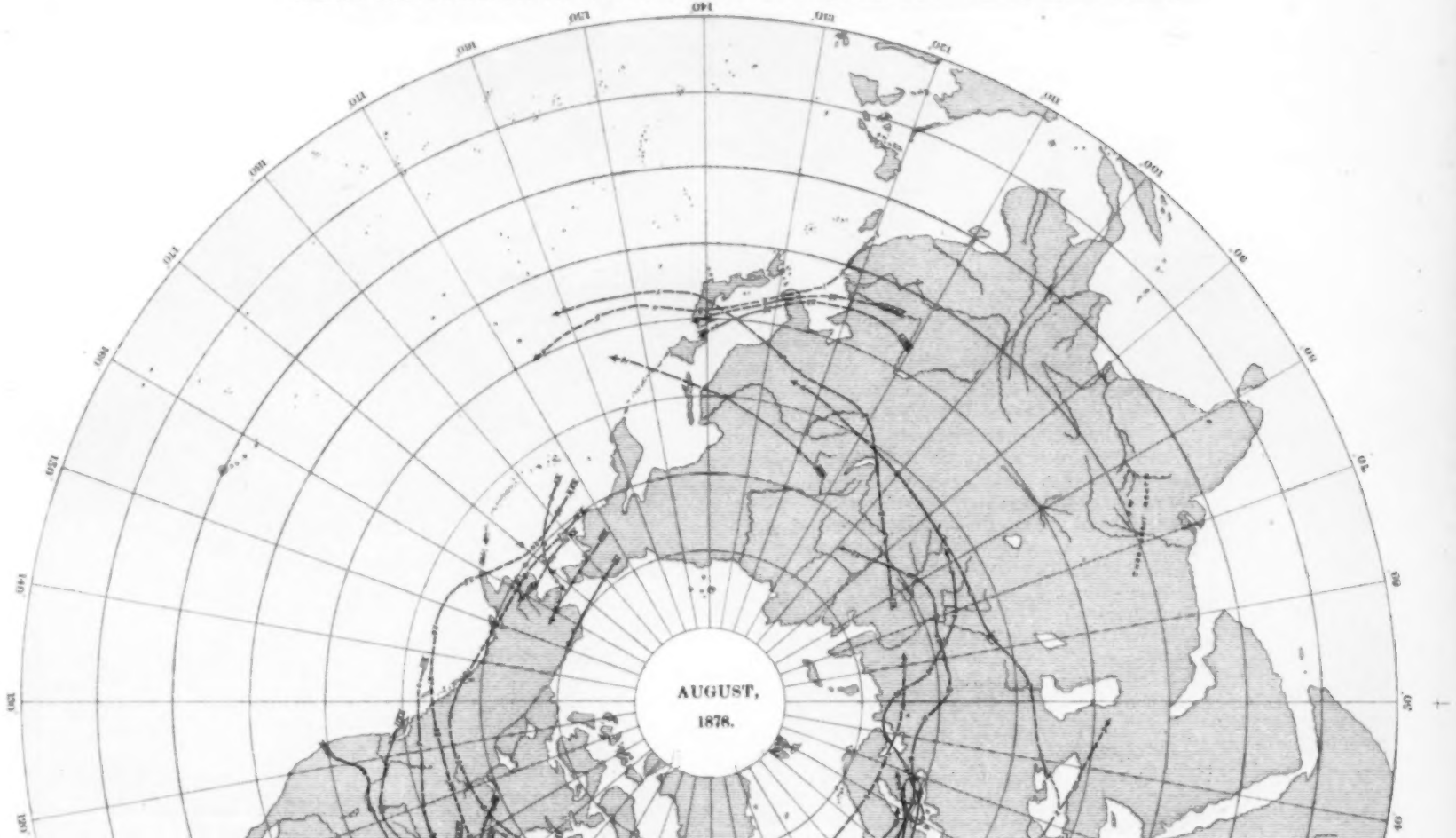
Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of August, 1878, based on the daily charts of the International Bulletin.

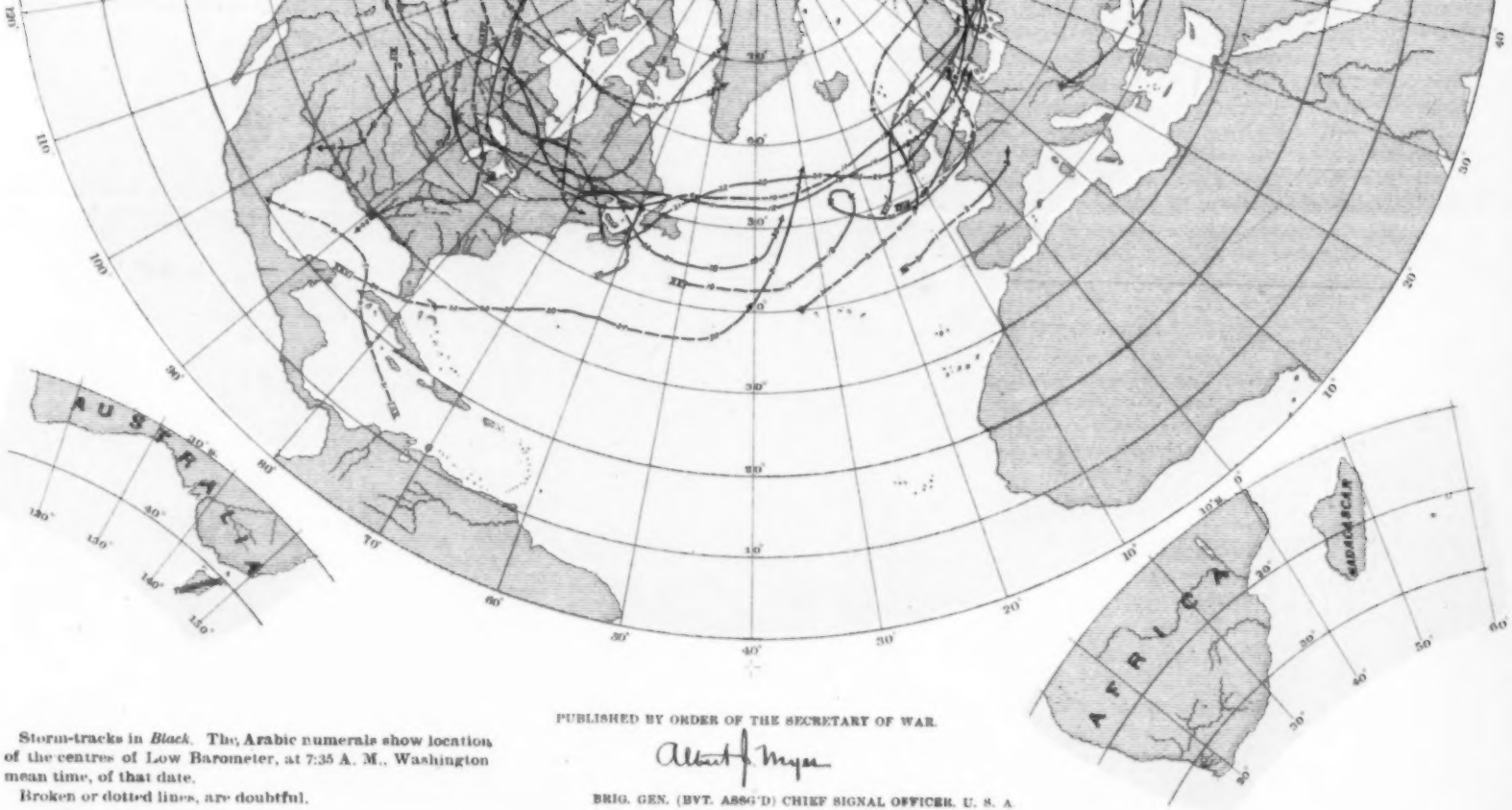
Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.

No. VI.





Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

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Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER. U. S. A.

INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for August, 1878.